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AT TAI-YUEN-FU THERE ARE TWIN PAGODAS. THE NEARER ONE LEANS ALMOST AS MUCH AS THE TOWER OF PISA

NATURAL HISTORY

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A Winter Journey in Northern China

By MALCOLM PLAYFAIR ANDERSON

NOTE.—NATURAL HISTORY has the good fortune to present to its readers another article by the late Malcolm P. Anderson. We quote from Professor Melville B. Anderson's letter placing his son's manuscript for publication in this magazine: "The article I enclose is no tale of sensational adventure, but a straightforward record of close observation in an out-of-the-way portion of the state of Shansi, China. Such a forest as is here described has become, since the days of Marco Polo, a great rarity in far Cathay. The photographs tell the melancholy story of the ruin of the soil by centuries of erosion, unimpeded by the forests that once covered the mountains."

The Journey

IT was a chilly morning in November when I left my inn at Tai-Yuen-Fu, the capital of Shansi Province, north China, bound on a trip westward into a region almost unknown to foreigners, and where Europeans and Americans are equally unknown to the inhabitants.

Besides muleteers I had with me only my cook and interpreter, Kang, and a Chinese hunter whom I called Joseph and whom I took chiefly as guide. The outfit of food, blankets, ammunition, and instruments was loaded on four pack mules, the loads being so arranged that the men could ride on top as much as they pleased. I had no intention of riding, for I knew I should have no difficulty in keeping up with the mules.

I may explain that this little expedition was only an incident in a systematic survey by myself of a considerable part of eastern Asia for the purpose of obtaining scientific specimens of animals and birds for the British Museum (London Zoological Society). I had heard of the existence of forested mountains in the direction I was taking, and I was anxious to do some hunting and trapping in the region before the coming of the severe winter weather.

Tai-Yuen-Fu is situated in a wide valley running north and south and traversed by the Fen-Ho, a broad, shallow stream of muddy water. Passing out of the west gate of the walled city, we crossed the river by a long, low, narrow bridge built of pine poles and covered with a thick layer of sorghum stalks. Then we began the ascent of the long, cultivated slope reaching from the river to the foot of the western hills. Peasants were flailing their millet that morning, and a few were plowing for winter wheat with teams composed of an ox and a donkey working together in a very docile manner. At one village a festival was in progress, and actors in soiled, fantastic costumes of some previous dynasty were reproducing a drama of mythology in a little, open theater stand. Across the road was a small Buddhist temple, on the steps of which the village dignitaries were gathered to watch the performance while the common people looked on from the narrow street.

After traveling for some hours, we entered a cañon in the treeless hills,

THE DRUM TOWER IN THE CENTER OF TAI-YUEN-FU

A MARKET SCENE ON A STREET IN TAI-YUEN-FU

THE TYPE OF WHEELBARROW USED FOR CARRYING COAL FROM THE MINES

A WHEELBARROW LOADED WITH PUMPKINS ON A STREET IN TAI-YUEN-FU

where we began to encounter frequent pack trains of mules with loads of coal from the mines a little above. Large-wheeled barrows also loaded with coal came heavily down the narrow, rocky path, the sound of their squeaking being heard afar. Each wheelbarrow was handled by two men, one guiding and pushing, the other in the lead pulling with a rope. Only the wretchedly poor will toil for a livelihood as these men do in order to get their coal to market. Less frequently we met trains of mules and donkeys loaded with bars of pig iron. As the muleteers seemed willing to keep on, we made no stop at noon that day, so that we reached the summit of the hills rather early.

Here was a hamlet of dugout dwellings, mere burrows in the loess banks. There was no inn, and the only house above ground was built of mud and stone and thatched with millet straw. I had hunted in this neighborhood a few weeks before and was acquainted with the peasant who owned this house, so I was able to get a room for the night. The room was furnished with a "kang" or sleeping platform raised about twenty inches above the ground, built of stones and earth and having underneath an opening for a fire. Here I caused a blaze of pine boughs to be kindled to heat the kang and the room, but, as the fireplace was not provided with a chimney, I was forced to walk about outside until the heating process was finished and the smoke had cleared away. Then, after my supper of boiled rice, Chinese steamed bread which I had brought from the city, and American canned meat, I made myself comfortable for the night by setting my camp cot on the heated platform.

The next day, continuing the journey, we first skirted the side of the summit near which we had passed the night, then took a ridge of the hills leading northward, and came before nightfall down to the Fen-Ho again. Looking at my map, I could not see why it would not have been better to ascend the river to this point, but later I learned that the Fen-Ho makes a great bend which geographers evidently have not discovered. By coming up over the hills we had in fact made a considerable cut-off.

On this second night we stopped beside the river at a village called Kuchow, which is about thirty-three miles northwest of Tai-Yuen-Fu. The houses of this place are built of gray brick and appear better than the huts of the hills; my inn, however, was as bad as even China can boast. Choosing from several hostelries the one that appeared best, we drove our mules through the great door into the large general room, which was already crowded with muleteers and other travelers. While the animals were being unloaded I looked around. There were no private rooms with the exception of one little place occupied by the innkeeper. The general room had on one side a long kang already crowded with sleepers. Near the door two dirty fellows were boiling millet and sweet potatoes on a stove constructed of stones and earth. The floor was littered with cargoes and packsaddles. Many voices were raised in exclamations and curses, while from the rear, where the animals were stalled in a long shed, came the continual jangle of bells and the braying of mules and donkeys. After a few moments the innkeeper came forward to welcome me, and surrendered to me his little room after turning out several ragged wretches who had been smoking opium there.

The walls of this room were blackened with smoke and loaded with the dust of all the years, no doubt, since the house was built. Under the kang, which was covered with a dirty, tattered reed mat, burned a fiercely hot coal fire which added to my discomfort. The partition separating the squalid cell from the general room was a mere latticework which had once been

A VILLAGE IN THE HILLS WEST OF TAI-YUEN-FU

THE HAMLET WHERE THE FIRST NIGHT WAS SPENT ON THE WAY TO CHAO-CHENG-SHAN

covered with paper,—now hanging in dust-loaded shreds,—so that whoever would, might look in on me. Needless to say, there was a crowd of curious onlookers,—so I got out some scraps of paper and had my servant stick them on the lower parts of the lattice. But this did not serve as a sufficient hint; ever and anon some rustic, bolder than his fellows, would burst open the door and stand staring at me. This went on until at last, losing patience, I gave the tenth uninvited guest a broader hint in the shape of a sprinkling of water, whereat he retreated to the great amusement of his companions, who roared with laughter.

The Chinese feed their work animals on chopped grain-stalks, usually millet straw mixed with maize or beans. This is doled out to the beast in small quantities and frequently. So it comes about that a Chinese caravansary is always a noisy place at night; the drivers are continually going out to feed their animals, the while incessantly shouting boisterously at one another and cursing the mules.

On the third day we turned up the valley of a tributary stream which enters the Fen-Ho from the westward. As we advanced, the mountains enclosing the valley to the north and south grew higher and more rugged, still however preserving their bare, yellow appearance. The valley was very stony, being little more than the bed of the stream in which there was at the time but little water. The fields were for the most part restricted to the valley and therefore stony; the villages that we passed were all poor; the mountainsides, too steep and infertile for cultivation, were given up to the pasturage of sheep and goats.

We traveled due west all day, covering a distance of perhaps twenty-five miles, and at nightfall we had almost reached the divide at the source of the stream. Joseph was acquainted with a peasant living in a small hamlet by the wayside, so we put up for the night at his house. The aged grandfather, clad in sheepskin coat and cap, welcomed us with all the ceremony he knew. Vacating the best room in his hut, he turned it over to us for the night. It was a far better place than that in which I had passed the preceding night.

My hunter and the muleteers represented it as impossible to reach the mountain for which I was bound in less than five days, but as I had arranged to go in four, I was determined to make an end on the fourth day. In the early morning we ascended to the divide which I had seen the day before; a slight snow was falling and a strong north wind blowing; all the higher mountains were enveloped in clouds. Looking onward from the pass, I saw no change in the character of the country. I paused on the divide and found that my aneroid barometer recorded an altitude of seven thousand feet; this surprised me but I later found the reading to be approximately correct.

Descending from the pass, still in a westerly direction, down another stony and nearly waterless stream bed, we reached before noon a rather large tributary of the Fen-Ho and a little town called Mi-Yueh-Cheng. The houses here, as at Ku-chow, were of gray brick. It was market day and the street was lined with peasants and merchants displaying their produce and wares on benches and tables as well as on the ground. Here my men wished to spend the fourth night, but I urged them on and so, after a short stop for a lunch, we took the trail indicated by Joseph toward the wooded mountain. That I had reached a wild, sparsely settled region was soon evident, for after we left the village, we passed but few dwellings, while trees and bushes became more and more abundant. We were following a small stream to its source, and late in the afternoon, in a drizzle of rain and snow which had con-

tinued all day and now became heavier, we reached another pass about a thousand feet higher than that of the morning. Through a momentary lifting of the fog I now caught a glimpse of the forested side of a mountain not far off. This was Chao-Cheng-Shan and I was glad, for until this day I had searched northern China in vain for a real forest.

Somewhat beyond the pass but still short of the woods we came upon a farmer's place on the steep mountainside. Had Joseph not been acquainted with the people, we might have had difficulty in persuading them to receive us; as it was, however, we were greeted cheerfully and were assigned for the first night to the family room, displacing the wife and children of the young farmer.

The house was a very rude affair,—a group of low buildings of earth and stones, clustered on the four sides of a small courtyard on a slope so steep that the roofs of the lower buildings were about even with the floors of those on the upper side. Most of the rooms were dark and smoke-blackened, but the one that was prepared for me the next day —for I decided to make the place my headquarters—had been newly added and was well lighted by one large window. This room was small but clean, except for the dust which inevitably comes from the earth walls of such buildings. The kang occupied the front of the room, and at the inner end was the fireplace, a mere flue extending under the kang, and in this case there was a chimney. Into the end of the platform over the fireplace were set two large kettles which had to be kept full of water whenever there was a fire, so that I had not only smoke but steam to endure. Moisture from the steam condensed upon the rafters and formed a coating of ice which grew thicker and thicker as the days passed.

The people of this lonely farm were very poor peasants, living by herding cattle and goats on the mountains and by cultivating small patches of ground near their home. They seemed to subsist chiefly on oats and potatoes. Besides the ordinary potato, which is good though small, a tuber about the size of a cherry is extensively grown. The oats they grind and boil into a pudding, or they parch and grind them to flour, and eat this mixed with water. This preparation tastes much like pop corn. Leeks are raised as a delicacy of which the people are particularly fond, and a certain amount of millet is grown.

I had brought with me, of course, my own food, but I purchased potatoes from my landlord and he had a few carrots which were a treat. One evening, by way of a compliment, he sent in to me some food of his wife's cooking. The dish consisted of layers of oaten dough rolled into cones and steamed until thoroughly done. I found it excellent. But after the first night I never went into the family room again, and really saw little of the people. I was constantly busy with my hunting, trapping, and preparation of specimens, and the father and son were at work all day thrashing their crop of oats on the earthen floor behind the house. The women kept inside because of the cold and also, doubtless, on account of shyness.

The Mountain Forest

The morning after my arrival, when I looked out, the sky was clear and the first rays of the sun were gilding the tops of the highest ridges in sight. My hut proved to be near the upper end of a deep cañon stretching from north to south and heading in the forest above. Below I saw only bare, buff-colored mountains and the pass we had mounted the previous afternoon. After breakfast I took my shotgun and ascended the ridge west of camp. Striking a trail on its top, I followed up southward, soon reaching the forest. Here I lost the path which was deep in

THE ISOLATED FARMHOUSE WHERE THE AUTHOR LIVED WHILE HUNTING AND TRAPPING ON THE MOUNTAIN

snow and overgrown with bushes; I struck through the thick growth of spruce and larch, taking the direction of what seemed to be the summit. The slope was steep, the forest dense, the soft snow knee-deep, so that I progressed slowly, gaining the top of this portion of the mountain only at the end of two hours. Thence I looked down to the southward on a fine scene of rugged snow-covered mountains, with here and there in the foreground a peasant's dwelling among bare fields on some cañon-side.

Chao-Cheng-Shan is a group of three summits. I was standing on the central mountain which then appeared to me to be the highest. Westward rose a peak, and southeastward was a level-topped summit similar to the one I was on. All the upper northern slopes of this mountain mass were covered with the admirable forest I so long had sought; the southern slopes were also wooded, although less extensively. I saw that morning, in the fresh snow, many tracks of wild animals,—deer, fox, hare, and marten, as well as smaller animals in abundance. I was delighted to find at last so good a place to obtain a variety of specimens. On that occasion, however, I came across no game except three Chinese pheasants, which went sailing across a deep cañon, looking, with their long tails, like huge dragon flies.

Within a day or two I found that a small species of deer is very abundant in this region. Accustomed only to the Chinese hunter with his wretched matchlock gun, they were very tame, and gave me many opportunities for close observation. These beautiful little white-rumped, almost tailless deer frequent the grassy tracts near the edge of the forest in which, if alarmed, they take refuge. They were sometimes solitary, usually in threes and fours; once I saw five together.

Joseph was the first to shoot a deer. He came in one day saying that he had wounded a buck but it had run so far that he could not follow. I insisted on his following it up immediately, whereat he went out again, but I suspected that he did not look for the deer at all. The next day he found it and brought it in,—what was left of it. During the night a leopard had devoured the hind quarters, leaving us the head and fore legs. I took the skull as a specimen and the unharmed flesh for food. A few days later we found a second full-grown male with the hind quarters devoured. As there was no evidence of its having been shot, I suppose it was purely the prey of some leopard, as several of these beasts were about.

The southeastern summit was inhabited by a tiger. I heard of this animal early in my stay but was skeptical until I discovered his tracks in the snow. The animal had lived there for many years and was of course dreaded by the natives, who proposed to organize a drive and rely on me to kill the tiger. A tiger did not mean much to me as a specimen, however, for I was busy with mammals far less known. Moreover, as I had had no experience in tiger-hunting, I felt that it would be more prudent to undertake such an enterprise in company with a veteran of my own race, rather than with a lot of excitable, chicken-hearted Chinamen.

One day about a week after taking up my lodging on Chao-Cheng-Shan, I started out as usual with my gun, and climbed the ridge west of the hut. There were two deer feeding at the edge of the forest; before they became aware of my presence, I had got between them and the woods, so that at my approach they ran down the valley. I followed the mountain-side through the thick woods to the western pass, where heavy fog was coming and going and the north wind was bitter cold. On the trees the fog had formed a most delicate and beautiful covering of ice crystals, and rocks and bushes were also wonderfully decorated.

IN THE WIND-SWEPT WESTERN PASS THE FOG FORMED BEAUTIFUL ICE CRYSTALS ON THE LARCHES

THE WESTERN PASS FORMED A BEAUTIFUL FRAME FOR THE DISTANT VIEW TO THE NORTHWARD

THE MOUNTAIN OF CHAO-CHENG-SHAN FROM THE NORTH. IN THE OPEN ON THE EDGE OF THE FOREST ROE DEER WERE VERY ABUNDANT

THE PEAK OF THE MOUNTAIN CALLED CHAO-CHENG-SHAN AND AN ARM OF THE NORTHERN FOREST

FROM CHAO-CHENG-SHAN ONE LOOKS OUT ACROSS MANY RIDGES OF TREELESS MOUNTAINS

LOOKING NORTHWARD FROM THE SIDE OF CHAO-CHENG-SHAN

Caring nothing for the cold and fog but feeling an impulse to go on, I found a trail skirting the southern side of the western peak, and this I followed until I was far beyond anything I had previously seen. The fog, which had been coming and going at frequent intervals, now settled about me densely. It occurred to me that I might get above the fog by going up; hearing the sound of some animal above me, I climbed some hundreds of feet up a ridge to see what it was, but the animal proved to be too far away, and an unknown cañon, filled with fog, yawned between me and the object of my search. Supposing that I could ascend the ridge and then easily descend again to the pass, I pushed on up through the snow and the fog, but in doing so I lost my bearings and became aware that I no longer knew in which direction the pass lay. Thinking to regain my little trail, I began to go down again, and soon found myself in the forest. On my way up I had not seen any trees; the fog, I thought, must have hidden them.

Down and farther down I plunged through the soft snow, and no trail could I see,—nothing but the trees a few rods ahead. At length I began to suspect that I was on the northern slope, and if so, I knew that if I got too low I might have difficulty with some deep and very precipitous cañons. I thought of turning back, following my tracks, but that would be a toilsome business, and by that route I could not hope to reach camp before dark. The sun,—where could it be? If I could but see the faintest indication of its direction! It must be near setting, but there would still be an hour of daylight. Suddenly I came to an opening, then to a trail running horizontally along the mountain. Thinking I had observed such a trail along the northern slope, I felt rather relieved, and turning to my right, eastward as I supposed, followed the trail.

After some time I mounted a ridge; it seemed to me that at last the pass was regained; if so, I must find my own tracks in the snow. In the fog the place looked wonderfully like the pass, but there were no tracks of mine. There as I stood in doubt, I saw, through a momentary lifting of the fog, not the crag that should rise on the opposite side of the divide, but a sheer cañon opening at my feet. I was certainly lost. There was no time to hesitate; I must make use of every instant of daylight in retracing my tracks. Unbuttoning my coat, I ran as steadily as possible back along the trail. Darkness would soon come down, probably long before I could climb back up the mountain. With that fog how dense the darkness would be! Feeling in my pocket for matches I found not a single one. If worst came to worst I might descend some cañon in search of a peasant's hut; but how would the people receive me, a foreigner whom they could not understand? They might think the evil spirit had paid them a visit! I thought of the other time that I had been lost in the mountains far away in Siskiyou, but that seemed nothing to this. There I had built a fire and calmly lain down to sleep, while here, if I failed to find a hut, I must walk all night to keep from freezing. There, the air had been but chilly, while here it was bitter cold with a wind blowing direct from the winter-bound desert highlands of the north.

Suddenly I paused in my run. The fog below had lifted a little, giving me a momentary glimpse of a peculiar seam of rock which I had noticed, traversing the country and forming cliffs on the sides of several cañons. I must therefore be on the northern slope! I was right when first I followed this path. Turning once more, my confidence restored, I passed along the mountainside again, and when, a second time, I reached the ridge which had seemed to be the saddle but was not, there only a few hundred yards ahead was the

actual pass. It was still rather foggy, but unquestionably the place I knew. The way to camp, though long, was now perfectly clear.

That night, as I slipped between my warm blankets, I thought again of my California experience and congratulated myself that it still remained the only time I had been lost for a night in the mountains.

The next day the fog left, not to reappear during my stay. The weather turned even colder; the little stream near camp, which had hitherto been running under the ice, now froze solid, and the mercury in my thermometer retired entirely into the bulb.

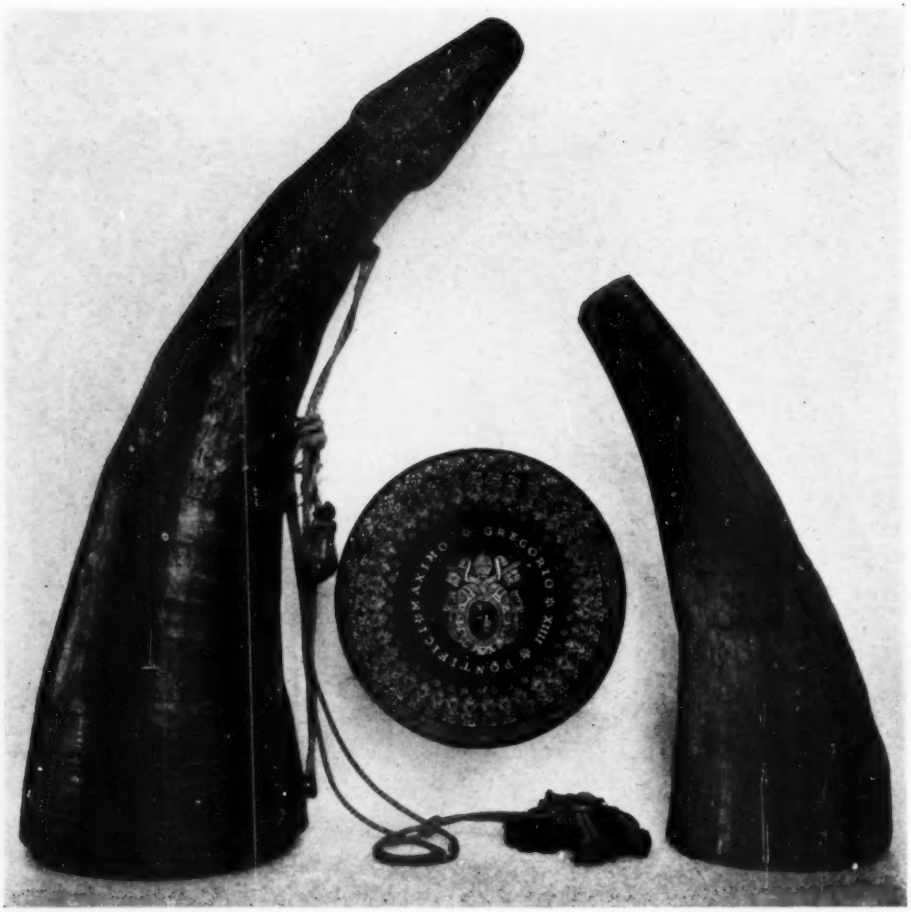
On the last day of November I set out to ascend the western peak, Mo-er-shan, the highest portion of the mountain. The day was clear and I expected a fine view from the summit. A tramp of an hour took me to the western pass whence I followed the track skirting the southern slope. This led me at first through an open tract, but soon, surmounting a rocky spur, I entered a thick hemlock forest that filled the head of a large cañon. Through this I made for the main ridge, which would lead me directly westward to the peak. On mounting the ridge, I found the going much less to my taste than I had thought it would be. Before I had reached the ridge, the hemlock forest of the south side had given place to a thicket of big, thorny plants much like the devil's-club of Alaska. It is a large-leaved plant about waist high, with long, poisonous thorns on both stalk and leaves. I found that the dense spruce forest of the northern slope met this thicket at the top of the ridge, so that I had to choose my way through one or the other. Among the trees the snow had drifted about two feet deep but had not settled and hardened. It had only a slight crust, enough to make me think now and then that it might hold me, but I plunged in at every step. Nevertheless, I held my way as much as possible in the forest until I reached the base of the peak, where the trees cease.

The peak proved to be composed of a mass of great fragments of granite, half-covered with snow and overgrown with low, thorny bushes. On account of the snow I found it difficult to tell whether the foothold was solid or whether I was stepping between the rocks into some crevice. I had not gone far before I hurt myself; after that I went cautiously, and eventually reached the summit.

North, south, and east, I looked over a seemingly endless succession of mountain peaks and deep, narrow valleys, stretching out and out until their outlines were lost in yellow haze. With the exception of a massive eminence far to the north,—which proved to be Ko-Lan-Shan,—no mountain appeared so lofty as the peak on which I stood. Westward I looked down upon loess hills, all artificially terraced and seamed by gullies where watercourses and roadways traversed them. Far out to the west, stretching from north to south as far as one could see, was a blue line marking the gorge of the Yellow River.

Stopping on the summit was extremely unpleasant on account of the icy wind from the north, but I did not neglect to read my barometer, which recorded an altitude of 11,800 feet. After reconnoitering the western side in search of a good way down, I descended the southern slope by jumping, at first, from rock to rock. Getting among the devil's-club and the smaller rock fragments, I was obliged to pick my way with greater heed. Although this route compelled me to cross two deep and precipitous cañons, I managed to reach the hut at an early hour in the afternoon.

The cold on Chao-Cheng-Shan became constantly more severe; and, as I had made a highly interesting collection of mammals and birds, I was glad to return early in December to more comfortable quarters in Tai-Yuen-Fu.



HORN OF INDIAN RHINOCEROS KNOWN AS ALICORNE OR UNICORN

Presented to Pope Gregory XIV, in 1590, because of its reputed medicinal qualities, by the Prior and Brothers of the Monastery of St. Mary of Guadalupe, Spain. This inscription runs around the rim of the cover while the top of the cover bears the arms and superscription of Pope Gregory XIV.

The missing tip, reduced to powder, was administered to the Pope in his last illness. The statement that it was used as an amulet is entirely erroneous. The horn was purchased by Dr. L. Pollak, of Rome, at the Ferroni sale of 1909, from whom it was obtained by Mr. John Marshall, who, at the suggestion of Dr. Bashford Dean, presented it to the American Museum in 1920

The Unicorn and His Horn

By FREDERIC A. LUCAS

"THE unicorn," writes Pliny, "has the head of a stag, the feet of an elephant, the tail of the boar, while the rest of the body is like that of the horse; it makes a deep lowing noise, and has a single black horn, which projects from the middle of its forehead, two cubits in length. This animal, it is said, cannot be taken alive."

One might suppose from the detailed description that it was written by some one who had actually seen the animal; in reality it has no firmer foundation in fact than the tusks of the narwhal, all the rest being supplied by the imagination of the writer.

The old zoölogists were indeed gifted with vivid imaginations, although, as animal psychologists, they were far behind some of the writers of today, for none of them ever credited a woodcock with surgical skill, much less a sponge with sufficient intelligence to adapt the time of laying its eggs to the currents and temperature. So, given the horn of the narwhal, the rest could be added. After all, this is not so surprising, for even today there is a widespread belief that a palæontologist can restore an animal from a single bone, a belief, it is needless to say, more flattering than accurate.

There are times when the early zoölogists seem a little hazy, and he who is following the trail of the unicorn through the pages of the literature of the past will find a tendency to confuse the unicorn with the rhinoceros, although the best systematists distinguished these under the term of monoceros or monocerate.

Thus Guillim, who wrote on heraldry in 1610, says: "The Unicorn hath his Name of his one Horn on his Forehead. There is another Beast of a huge Strength and Greatness, which hath but one Horn, but that is growing on his Snout, whence he is called *Rhinoceros,* and both are named *Monoceros,* or One-horned. It hath been much questioned among Naturalists, which it is that is properly called the Unicorn: And some hath made Doubt whether there be any such Beast as this, or no. But the great esteem of his Horn (in many places to be seen) may take away that needless scruple. . . . Touching the invincible Nature of this Beast, Job saith, 'Wilt thou trust him because his Strength is great, and cast thy Labour unto him? Wilt thou believe him, that he will bring home thy seed, and gather it into thy Barn?' And his Vertue is no less famous than his Strength, in that his Horn is supposed to be the most powerful Antidote against Poison: Insomuch as the general Conceit is, that the wild Beasts of the Wilderness use not to drink of the Pools, for fear of the venemous Serpents there breeding, before the Unicorn hath stirred it with his Horn. Howsoever it be, this Charge may very well be a Representation both of Strength or Courage, and also of vertuous Dispositions and Ability to do Good; for to have Strength of Body, without the Gifts and good Qualities of the Mind, is but the Property of an Ox, but where both concur, that may truly be called Manliness. And that these two should consort together, the Ancients did signify, when they made this one Word, *Virtus,* to imply both the Strength of Body, and Vertue of the Mind. . . .

"It seemeth, by a Question moved by *Farnesius,* That the Unicorn is never taken alive; and the Reason being demanded, it is answered 'That

the greatness of his Mind is such, that he chuseth rather to die than to be taken alive: Wherein (saith he) the Unicorn and the valiant-minded Souldier are alike, which both contemn Death, and rather than they will be compelled to undergo any base Servitude or Bondage, they will lose their lives.'"

Whatever uncertainty there might be as to the animal, there was none as to the medicinal value of the horn, be it that of unicorn, alicorn, monoceros, or rhinoceros.

The standard works on zoölogy and medicine from the time of Pliny onward all testify to the potency of the horn of the unicorn, and to these well-known authorities, Mr. John Marshall has added some interesting extracts from a work compiled by Andrea Bacci, of Florence, in 1573, entitled *L'Alicorne, della sua natura et della sue virtu.*

Thus Bacci, quoting Signor Mundella, "the highest authority of all," states that he places a high value on the monoceros horn as an antidote against poison and the bites of mad dogs and other poisonous animals, while various authorities consider it efficacious against pestilential fevers, bubonic plague, and even mushroom poisoning. And yet Mundella—as he ingenuously admits a little later—had never even seen a horn!

If we marvel at the credulity of the learned men of the Middle Ages, at their taking so many things on faith, we have only to recall a few of the fads of the present generation. It is not so many years ago since the blue glass craze swept over the land; yesterday we were seeking earthly immortality by drinking sour milk; today it is the light-hearted yeast cake that is to lengthen our days; tomorrow it will be "something just as good."

And if it seems strange that no one considered it remarkable that a patient sufficiently wealthy to procure a dose of unicorn powder should die, the explanation was simple: either the precious horn was given too late, when the patient was *in extremis,* as was the case with Pope Gregory XIV, or the dose was too small. Truly a difficult answer turneth away argument.

That it was not used more commonly was on account of its rarity and price. For unicorn horn was not a poor man's medicine; it was reserved for princes and potentates, the capitalist class of those days; the quotations on unicorns vary from $12,000 upward, extra fine being valued at $150,000 or, considering the purchasing power of money then, about half a million dollars of our present currency.

From Bacci we gather that it was given for mushroom poisoning as well as for other ailments. The customary dose was about ten grains administered either in wine or water, and it was well to give at the same time an emetic—an item that possibly accounts for its success in curing mushroom poisoning.

There seems to have been a belief that the medicinal value of a drug or other substance employed in medicine, bore some relation to its scarcity and costliness. Thus we are told that Gregory XIV was kept alive for some days by the administration of gold and jewels, although at the last the horn of the unicorn failed to preserve his life.

This very horn, now of historic interest, and all the more valuable because it lacks the tip administered to Pope Gregory when *in extremis,* has just been presented to the American Museum by Mr. John Marshall. As we learn from the inscription around the cover of the case in which it was preserved, it was presented to Pope Gregory XIV in 1590, by the Prior and Brothers of the Monastery of St. Mary of Guadalupe. It is just possible that it was given because it was known that the Pope was already in

poor health and there could be no better gift than a restorative. Be this as it may, the incumbency of Pope Gregory XIV was brief, lasting but a year, and the precious horn that was administered at the last proved unavailing.

Now and then some bold spirit seems to have been skeptical as to the value of some of the drugs in vogue, and Mr. Marshall quotes Muratori who, writing of the very case we have considered, says, "From the historian's statement he [Pope Gregory] was kept alive for a few days by virtue of the gold and jewels they gave him, he paying as a fee the sum of $15,000. We must conclude that the good Pope either had about him some quack doctors or very slick thieves." But heresy such as this is rare indeed and there is possibly a bit of professional jealousy here of the man who received a fee of 15,000 scudi.

As Lincoln said, there is a great deal of human nature in most people, and no matter how far back we go in the past, we find the same tendencies as nowadays. So it is not surprising to learn that there were counterfeits of so precious a drug as unicorn's horn, although these might be recognized by giving "Red Arsenic or Orpiment to two pigeons, and then to let them drink of two samples; if genuine, no harm would result—if adulterated, or false, the pigeons would die."

The unicorn is mentioned several times in the Old Testament, or rather the term *reem* has been translated to mean *unicorn*, but although all that is said in the Book of Job and elsewhere would apply to the rhinoceros, it is now considered that the word applied to the wild ox.

"Will the Unicorn serve thee, or will he tarry by thy Crib? Canst thou bind the Unicorn with his Band to labour in the Furrow or will he plough the Valleys after thee?" [1]

The zoölogist is at a loss to understand where the Israelites could have made the acquaintance of either the rhinoceros or the wild ox.

How the unicorn came to symbolize the Holy Spirit and how it found its way into heraldry, simply changing its Italian name *alicorne* to *licorne*, books at hand do not tell, but it became popular with Scotch heralds. A pair was taken, as we know, for supporters on the arms of the King of Scotland and, upon the accession of James VI to the throne of England as James I, one of them was transferred to the English royal coat of arms, where today it still stands on guard with the lion.

[1] Job, Chap. XXXIX.

The arms of the King of Scotland. From Grant's *Manual of Heraldry*

CENTRAL ALBERTA IN THE TIMES OF THE DINOSAURS

A broad, swampy delta with semitropical vegetation bordered the great interior sea that extended north from the Gulf of Mexico. Here lived the great dinosaurs of the Cretaceous period. The picture shows three kinds of duck-billed dinosaurs whose skeletons were found in the "bad lands" along the Red Deer River (see cut on page 537) and which may be seen in the museums of New York, Toronto, and Ottawa. Restoration by R. Deckert. (*After Barnum Brown*)

The American Museum fossil camp on Red Deer River, Alberta. The bad lands in the background show the geological formation in which the dinosaurs occur

Canadian Dinosaurs

By W. D. MATTHEW

UNTIL recently Canada has not been considered a very promising field for the fossil hunter. Considering the area of the Dominion and the amount of first-class geological surveying that has been done there, the number of important fossil finds is surprisingly meager. The reason might be partly that the "bad lands" which afford such favorable conditions for fossil hunting in the western United States are very little developed in Canada. There are no deserts, and even the arid or semi-arid areas are of limited extent.[1] The covering of vegetation over practically the whole country conceals from view such specimens or indications of fossils as may be exposed by erosion, and there is but little opportunity for systematic search of the outcrops of the rock formations. Moreover, the glaciers which covered the greater part of the Dominion during the great Ice age, have swept away all of the surface soils and much of the softer rocks of the later geological periods, redepositing them as moraines and other glacial deposits, but utterly destroying whatever fossil bones they may have originally contained.

Some Notable Fossil Finds in Canada

In spite of these handicaps, some notable discoveries of fossils have been made in Canada. Among these is the discovery of the (then) oldest known terrestrial quadrupeds in fossil tree stumps in the South Joggins coal measures of Nova Scotia. This was a famous find in its day, and is still important in palæontology.[2] Of more recent discovery but in an older geologic formation are the wonderful specimens of fossil fish from the Devonian shales of Scaumenac Bay, on the Gaspé coast of Quebec.[3] More

[1] About 20,000 square miles of Canada, mostly in southern Alberta, have a rainfall of less than ten inches. The forest areas, on the other hand, cover more than 2,000,000 square miles, of which it is estimated that 1,250,000 square miles are actual woodland.

[2] Some of these specimens are in McGill University Museum, Montreal. Others are in the British Museum or elsewhere in London.

[3] The finest specimen from this locality was obtained by Professor William Patten for Dartmouth University, but there are many fine specimens in various museums of the United States, Canada, and England. The American Museum has a valuable series.

ancient than these, but even more marvelous in their perfect preservation, are the Cambrian invertebrates obtained by Dr. Charles D. Walcott in recent years in British Columbia.[1]

The Alberta Dinosaurs

The dinosaurs of the Red Deer River in Alberta are of more popular interest than any of these finds and are equally important to science, although by no means so ancient geologically. The American Museum has taken a principal part in the discovery and collection of these dinosaurs and in scientific researches upon the specimens. It may therefore be of interest to members of the museum to sum up what has been done here and elsewhere.

The first important discoveries of dinosaurs in Alberta were two skulls collected on the Red Deer River by Tyrrell in 1884 and Weston in 1889, and described by Professor Cope as carnivorous dinosaurs. In 1897 to 1901 Lawrence Lambe, the Canadian palæontologist whose death was noted in NATURAL HISTORY, made considerable collections in this district, mostly of very fragmentary material, which were described in a memoir by Professor Henry Fairfield Osborn and Mr. Lambe in 1902. A few years later a letter from Mr. John C. Wegener, a ranchman at Tolman, Alberta, called the attention of Mr. Barnum Brown of the museum to the great abundance of dinosaur bones in certain areas on the Red Deer River. This served to crystallize Professor Osborn's plans for a thorough exploration of this promising fossil field, where Mr. Barnum Brown spent seven seasons, from 1909 to 1915. He found it advisable to devise new methods of exploration, which are described in an article in the AMERICAN MUSEUM JOURNAL for December, 1911, "Fossil Hunting by Boat in Alberta." The collections obtained were very large and extraordinarily complete, including a series of articulated and more or less perfect skeletons of various kinds of dinosaurs. These collections are now at the American Museum; our preparation staff has been at work upon them ever since and will be busy for some years to come before all are prepared for exhibition.

Meantime the Canadian Geological Survey undertook a vigorous and very successful campaign in the same district from 1912 to 1916, enlisting the veteran collector, Mr. Charles H. Sternberg, and his sons, to work under Mr. Lambe's direction. A fine series of skulls and skeletons was obtained for the Survey collections and the preparation and description of these specimens were well advanced when halted by the exigencies of the great war and by Mr. Lambe's sudden illness and death in the midst of his researches.

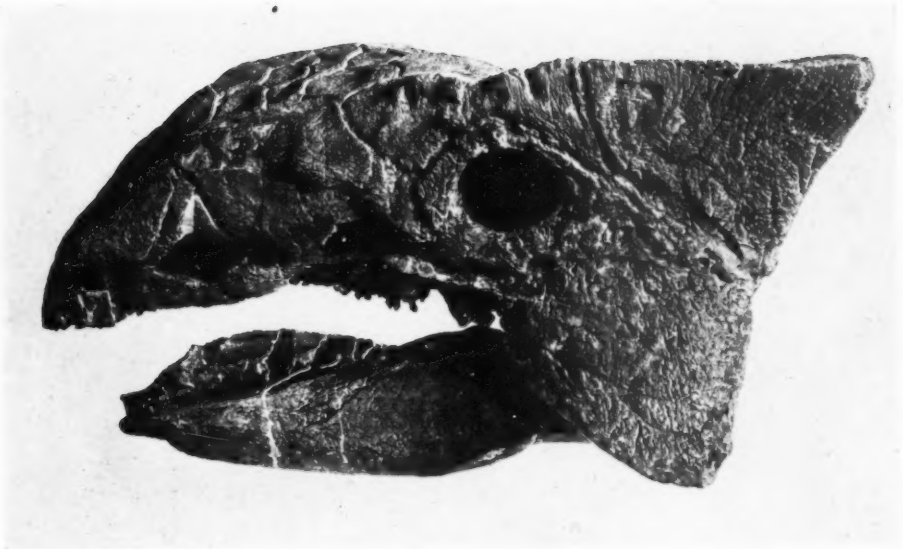
Several other institutions, notably the Calgary Museum, the University of Toronto, and the British Museum, have obtained important material from this rich fossil field, which, as Mr. Brown has pointed out, is likely to be practically inexhaustible, new specimens being exposed year by year owing to the comparatively rapid erosion by rain and river.

The American Museum Collection of Alberta Dinosaurs

At present there are nine complete skeletons of dinosaurs from the Red Deer River on exhibition in the American Museum, besides six skulls and two partial skeletons. Five more skeletons are being prepared, and various other specimens remain as yet untouched. Nearly half of our entire dinosaur exhibit at present is from this district; in a few years it will be more than half.

Nearly all the skeletons are exhibited as panel mounts, that is to say, they are chiseled out in partial relief

[1] These are in the United States National Museum. I do not know of any elsewhere.



Skull and jaws of the great armored dinosaur *Ankylosaurus*, "the most ponderous animated citadel the world has ever seen." The broad, squat body of this animal was completely shielded by massive plates of bone. Even the eyes were protected by movable bony curtain lids. Besides skulls and skeletons, two specimens have been found on the Red Deer River with the armor in place. One is in the American Museum, the other in the British Museum

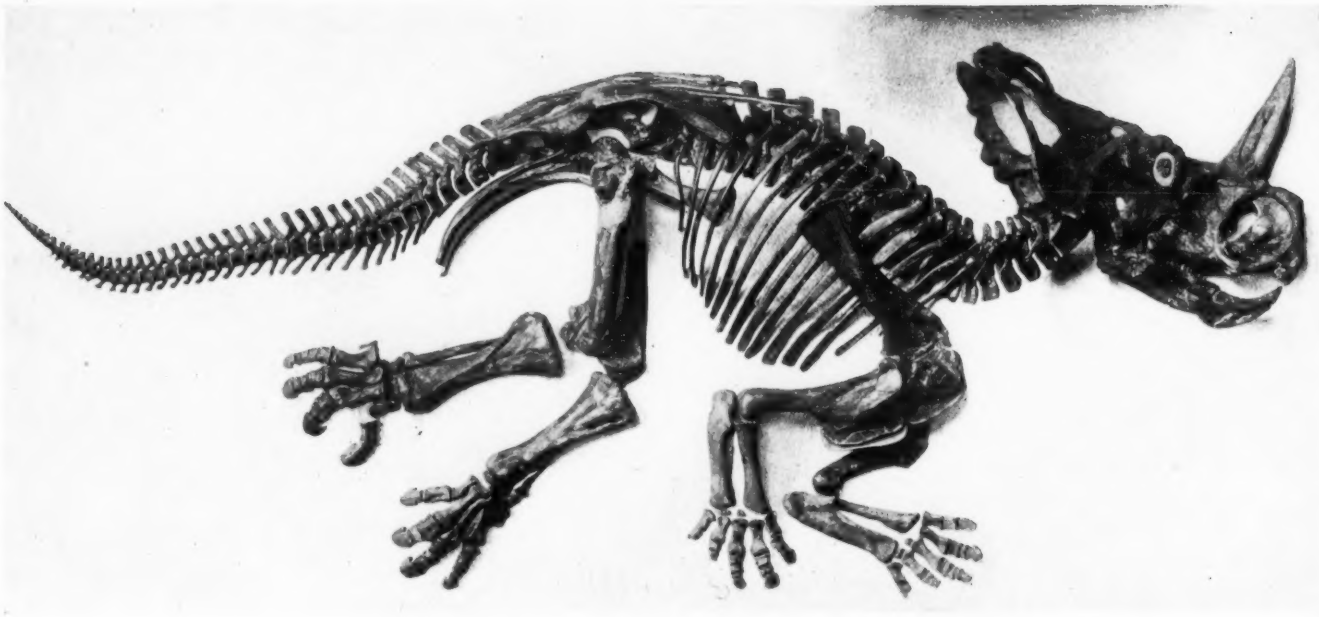
but still remain partly buried in a squared block of the original rock stratum, or in plaster tinted and finished to match it. This is a preferable method when a fossil skeleton is somewhat crushed but well articulated and does not lie confusedly in the rock; it is the necessary method when a skeleton is very much crushed or squeezed flat. The Alberta dinosaurs, while not badly distorted, are usually somewhat crushed, and most of the skeletons collected are very well articulated, so that they can readily be mounted as panels. This method shows immediately that the skeleton is a fossil, and although it does not show the original form of the animal as well as an "open" or "full relief" mount, yet it may sometimes give a more easily seen and better remembered picture than the other.

Readers of this magazine hardly need to be reminded that the "dinosaurs" include a wide variety of extinct animals, as various and diverse in appearance and habits as the "quadrupeds" among modern animals. The dinosaurs of the Upper Cretaceous formations of Alberta included probably as great a variety of animals as the large quadrupeds of Central Africa. We have only a few, probably, of the more common and characteristic kinds, but they are different enough to be worth examining separately and contrasting one with another. All of them are "queer" and strange to our eyes, which are accustomed to see the characteristic forms of the mammalian quadrupeds. Perhaps they would have appeared more natural had we lived during the Age of Reptiles.

There are five principal groups among the dinosaurs, all except the last including quite a variety of different types: (1) Duck-billed dinosaurs or Trachodonts; (2) Horned dinosaurs or Ceratopsians; (3) Armored dinosaurs or Ankylosaurs; (4) Carnivorous dinosaurs or Megalosaurs; (5) Ostrich dinosaur (*Struthiomimus*).

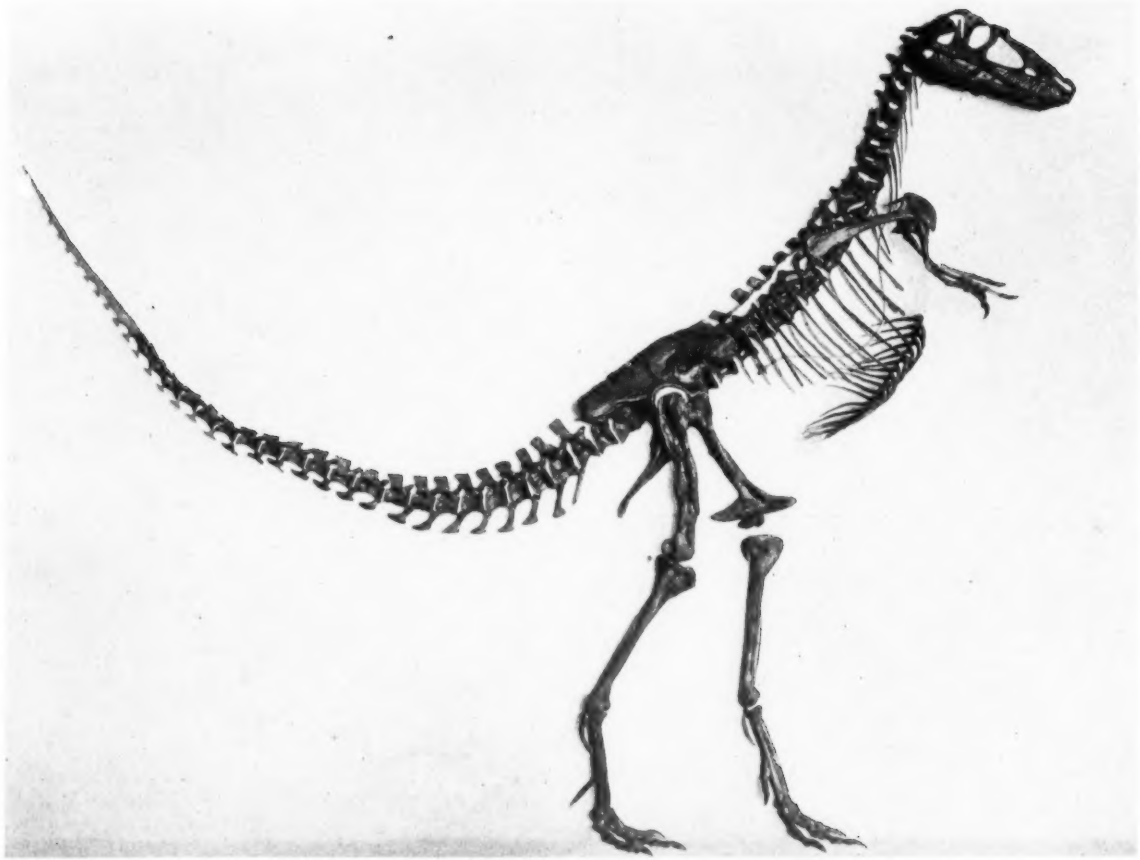
Duck-billed Dinosaurs

There are four skeletons and three skulls to represent this group. The duck-billed dinosaurs or Trachodonts get their name from the flattened, toothless, horny beak or bill. They



SKELETON OF A HORNED DINOSAUR, MONOCLONIUS

This nearly complete articulated skeleton is in the American Museum. It is in position as found in the rock, except for the forefeet which were exposed on the surface, disorganized and partly destroyed by weathering. It had a single large nasal horn and rudimentary horns over the eyes. The *Triceratops* of Wyoming had a large pair of horns over the eyes but the nasal horn was rudimentary. (*After Barnum Brown*)



SKELETON OF A GREAT CARNIVOROUS DINOSAUR, DEINODON

Found by Mr. C. H. Sternberg in the Red Deer River bad lands, and now in the American Museum of Natural History. The skeleton stands about twelve feet high

have long, heavy hind legs, rather weak, slender fore limbs, and a long, powerful flattened tail. They seem to have been amphibious, equally fitted for wading or swimming in the water or walking on dry land. On land they would probably walk principally on the hind legs, but could drop on all fours to feed.

Until the discovery of the Alberta dinosaurs there was only one kind known, the *Trachodon*, a huge sort with an enormous wide, flat bill.[1] But in the Cretaceous formations of the Red Deer River, the Edmonton and Belly river beds, a remarkable series of duck-billed dinosaurs has been discovered. Among others there are:

(1) *Saurolophus,* with a smaller bill and a great spike on the back of the skull. Skeleton on exhibition in dinosaur hall.

(2) *Corythosaurus,* with a much smaller bill and a great crest on the top of the skull like a Phrygian helmet. One skeleton with a great part of the skin and another without skin but very perfectly preserved.

(3) *Stephanosaurus* also had a high crest on top of the skull, but of quite different shape. Two skulls in the American Museum exhibit; a skeleton in the Ottawa Museum.

(4) *Prosaurolophus,*—much like *Saurolophus,* but with a rudimentary spike on the head. Skull in the American Museum collection.

(5) *Procheneosaurus,*—a small kind with little bill and short round head. A fine skeleton on exhibition in the American Museum.

(6) *Kritosaurus,*—long, broad, depressed beak and peculiar prominent "Roman nose." Skulls in American Museum and Ottawa; a fine skeleton in the Toronto Museum.

[1] Represented by three skeletons in the museum exhibit,—the group of two skeletons, one standing upright, the other on all fours, feeding; and the "dinosaur mummy" lying on its back with the head tucked under the body and the shrunken skin still covering the bones. These three skeletons are from Montana, South Dakota, and Wyoming, respectively; but all are from the same geological formation, the Lance or latest Cretaceous.

Horned Dinosaurs

These were a very different kind of beast from the duck-billed dinosaurs. They had somewhat the proportions of a rhinoceros, with stout, heavy, short limbs, rather short tail, thick neck and huge head, armed with one or more sharp horns in front, and protected by a great bony crest or "frill" behind. It is supposed that these animals were wholly terrestrial and certainly must have walked on all fours.

Here again the Alberta formations have revealed an unsuspected variety of kinds. The *Triceratops,* whose skull and skeleton have been found in Montana and Wyoming, does not occur, but there are three or more other kinds, especially *Monoclonius,* with a single large horn over the nose (instead of the pair of large horns over the eyes seen in *Triceratops*); *Ceratops,* with horns arranged more like *Triceratops,* but smaller and with a different type of frill. *Anchiceratops* has horns over the eyes, but they spread outward instead of forward, and the "frill" is ornamented with scalloped edges; *Styracosaurus* has a frill set with huge bony spikes; and probably there were others. All of these except the last are represented by one or more skulls in the American Museum exhibit; *Monoclonius* also by a complete skeleton (the only complete skeleton of a horned dinosaur yet discovered) and by a partial skeleton showing a good deal of the skin preserved.

Armored Dinosaurs (Ankylosaurus)

This is a third group of vegetarian dinosaurs totally different from either of the others. They had a very small triangular head, enormous wide body covered with large bony plates, short massive fore and hind legs, and a heavy tail armor-plated to the tip.

The armor of neck and tail was arranged in overlapping rings to allow movement, and the limbs probably could be folded in under the wide flat body for protection.

This group of dinosaurs was first discovered by Mr. Brown in Montana, but the best specimens have been found in Alberta, from which we have a series of skulls and other parts on exhibition, and a complete skeleton in preparation, as also a partial skeleton preserving a great part of the skin and armor plates in position. Another partial skeleton with skin is in the Natural History Museum in London.

These three kinds of dinosaurs were all herbivorous beasts, feeding upon leaves and twigs or upon the softer and more succulent water plants. Their teeth were suited for grinding and chewing such food, and the horny plates of the beak would serve to clip it off. Their feet have wide, flattened hoofs on the toes. They are quite unfitted to attack and prey upon other animals, but are able to defend themselves against attack in different ways: the duck-billed dinosaurs by retreating into the water, where their active swimming and wading would enable them to escape; the horned dinosaurs by the great sharp horns and protected skull; the armored dinosaurs by their completely mailclad body. There was, however, another group of dinosaurs, equal-

Skull of *Corythosaurus*, a duck-billed dinosaur from Alberta. The lofty cranium is not a "dome of thought," for this dinosaur had just as little brain as his low-browed relative, *Trachodon*. It is simply a bony crest whose shape suggests the casque of the living cassowary; hence the name *casuarinus*. In all dinosaurs the brain was small and of reptilian type, as in the living crocodiles

ly gigantic and remarkable, that was carnivorous, with sharp, cutting teeth and claws adapted to prey upon other dinosaurs or upon smaller animals.

Carnivorous Dinosaurs

All of these were bipeds, running or walking upon the long, powerful hind legs, while the fore legs were often quite absurdly small in proportion. The teeth were sharp, compressed, with serrate edges, and the claws long and curved like those of eagles. The Canadian dinosaurs of this group were not so large as the huge *Tyrannosaurus* found in Montana and Wyoming,[1] but they were formidable beasts, far surpassing any modern beast of prey in size, and proportioned very differently, more like a gigantic lizard, but with the short body, long legs, and three-toed feet of a huge bird. The American Museum has obtained a fine series of skeletons of these great "Deinodonts." Two have been placed on exhibition, the larger one in the position as found, with the head drawn back, the legs sprawled out sideways, and the tail tucked under the body. A smaller species is in a standing pose as though reaching up to peer over the reeds and bushes of the jungle in search of prey. Two other large skeletons are being prepared; one of them, mounted in a running pose, will be on exhibition about the time this article is published. The Ottawa Museum has also a fine skeleton of this type, which Mr. Lambe described under the name of *Gorgosaurus*.

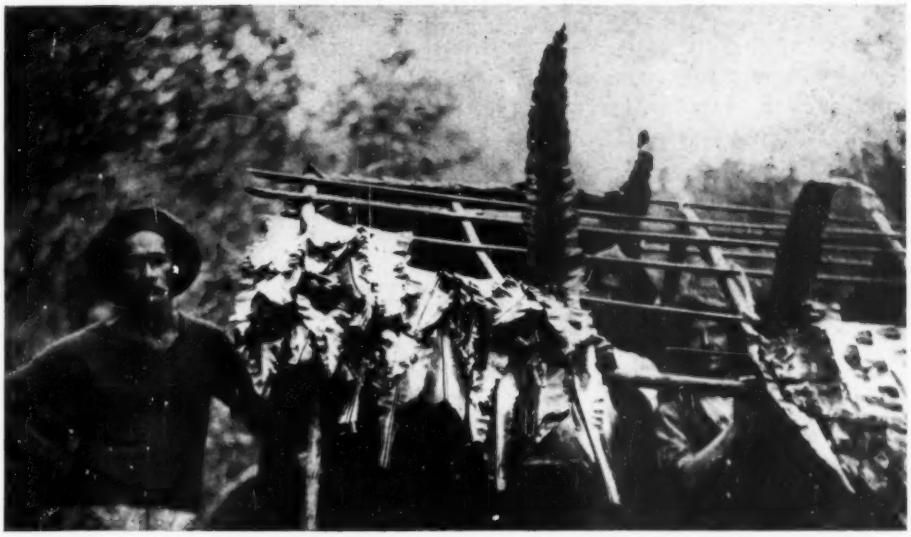
Besides these larger kinds there were also small carnivorous dinosaurs of which only fragmentary specimens have yet been found. They were from six to twelve feet long, more slenderly proportioned than the great Deinodonts, but otherwise similar.

The Ostrich Dinosaur

This has been confused with the small carnivorous dinosaurs, but was really quite a different animal. It had a long, slender neck and very small skull, the jaws without teeth, but with a bill like that of an ostrich. The hind limbs were very long and slim, with three-toed birdlike feet; the fore limbs, however, were not reduced as in the Deinodonts, but were also comparatively long and slim, with feet that are curiously suggestive of those of a tree-sloth in their proportions. The claws were comparatively long and were not compressed and curved as in the carnivorous types. This animal has been named *Struthiomimus* or "ostrich mimic" by Professor Osborn. Evidently it was not a beast of prey, but was adapted to some special mode of life; just what is still doubtful, although several ingenious suggestions have been made. A finely preserved and nearly perfect skeleton of the *Struthiomimus* is in the dinosaur hall of the American Museum. It is a rare type, and the next best specimen is a fore limb obtained for the Ottawa Museum by Mr. Lambe.

In addition to all these various kinds of dinosaurs, the Red Deer River has yielded a fine series of fossil turtles, crocodiles, and other remains of less interesting extinct animals. But it is and will continue to be famous as the greatest dinosaur locality in the world, the source of half the American Museum's dinosaur collections and of many choice skeletons that are, or will be, the pride of various other institutions.

[1] The skeleton of *Tyrannosaurus* is on exhibition in the dinosaur hall of the American Museum. It is 48 feet long, and stands 18 feet high. The jaws are 48 inches long.



A roof of banana leaves.—Our camp was roofed over with the broad-fronded leaves of heavy ferns, or those of a mountain tuber; again, the leaves of the wild banana plant were made to do service as a protection against the tropical downpour that assailed us occasionally

Ten Days in Tahiti

By ROLLO H. BECK

THE first word from the American Museum's South Pacific Expedition comes in the form of a communication from Mr. Beck, detailing his experiences during a ten days' bird collecting trip in Tahiti.

HAVING made arrangements for a two weeks' trip into the mountainous interior of the island of Tahiti to study the bird fauna, we locked up the small cottage in Papeete on the morning of October 11 and started for the mouth of the Punaruu River, where our two guides were awaiting us.

The ten-mile motor ride along the western side of the island was very pleasant in the early morning. Mina-birds were calling loudly from the tops of the taller trees; beautiful black-capped terns sailed back and forth over the smooth lagoon; a wandering tattler whistled plaintively as it flushed from a rocky point on the shore, while the steady boom of the breakers on the barrier reef a mile off shore was softened by the rustling of coconut leaves as the morning breeze swept through them.

Interspersed with neglected coconut groves were little patches of finely cultivated ground where Chinese gardeners raised in rigidly straight rows the various vegetables for which they found a ready market in Papeete. As the car stopped by the newly painted bridge across the Punaruu River, the guides stepped alongside and soon had our baggage in four sacks which they tied to two stout poles, and, shouldering these, they led off into a narrow trail toward the deep gorge through which flowed the Punaruu. At its mouth the cañon was more than half a mile wide, but it narrowed rapidly until in places it was less than a hundred yards, with precipitous walls on both sides.

Three miles from the entrance we came suddenly to a small tract where an industrious native had cleared off a bit of the steep, rocky hillside and planted it to papaya trees which were heavily laden with green fruit. We walked steadily for three hours, wading back and forth across the stream as one side or the other seemed best, but at eleven o'clock we turned out of the main cañon and picked our way up a little stream that trickled down between two narrow walls. Stopping by a shady pool, Tafia, the leading guide, dropped his load and pointed up the left wall to indicate our route.

A slight trail seemed to lead upward, so after a leisurely lunch, we began the thousand-foot climb, topping the cliffs close by a couple of coconut trees. After a few minutes' rest and a drink of fresh coconut milk, we started forward again through the gloomy forest, emerging finally at a little depression where a grassy pond of water harbored a dozen golden plover recently arrived from Alaska to spend the northern winter season along the Polynesian shores. The migratory habit is strongly implanted in these birds, for, although nesting in Alaska, they range in winter over numerous Pacific Ocean islands, and wander as well over a large part of South America. I remember them swinging into Argentine wheat fields late in September and in March flying about in nervous fashion along the shores of Lake Junin at 13,000 feet in the Andes just before beginning their flight toward the north.

A mile beyond the pond we stopped by a rivulet for the night. We had anticipated making for ourselves a leaf-covered hut, but instead were compelled to tie our canvas sheets together for a shelter, as suitable leaves for roofing grew nowhere near us. The scarcity of birds during the first day was attributed to the rain, for we collected only a dove, a swallow, and a kingfisher; as it happened, however, these were the only three native species taken on the trip.

The next morning was bright and hot, so we decided to stop a day and see what birds were in the vicinity. Tafia started out with Mrs. Beck and myself toward the foot of the towering cliffs that bounded the plateau on the east. Before reaching the base of the cliffs, we began seeing roughly built walls of stone which stood a foot or two above the ground on the lower side, while on the upper the soil had filled in level with the top. We saw dozens of these walls during the day and wondered what the former inhabitants of this rocky hillside once did for a living.

An occasional cooing dove or chittering kingfisher was heard but seldom seen in the tall trees that stretched up through the lower tangle of bushes. We did secure a couple of each, though. Later, while we were enjoying some juicy oranges at the base of the tree from which the guide had dropped them, we noticed a good-sized wild pig walk out of the brush a hundred yards below us. It had evidently heard the oranges drop to the ground and had taken the thuds as a signal not to be disregarded if other pigs were in the vicinity. It gazed up toward us while we kept perfectly still and then it started walking slowly up through the brush. I quickly changed the charges of small shot for two number sixes and, when the pig had approached sufficiently close, fired one barrel of the twenty gauge which was as effective as a rifle ball would have been.

Tafia, all smiles, at once began to break up sticks and limbs, and piling them carefully together, fired the heap; after which he enclosed the fire with large lava chunks and, as the fire began to burn well, piled still more rocks on the burning mass. In about ten minutes conditions seemed to be to his liking, so he took the porker and began pulling one side of the body rhythmically back and forth over the heated

rocks. In a short time clear, clean patches began to appear on the scraped surface, and a few deft pulls with his fingers under the legs and about the ears completed the depilating process on one half the beast. He then repeated the process on the other side. We were astonished at the ease with which a dirty, bristly, brindle pig had become a clean, smooth, white-skinned, although skinny hog. In less than half an hour from the time the pig walked up to us we were walking away campward with his clean, bristleless body.

Since Tafia had shown such skill and proficiency in removing the hirsute covering of our prey, we decided to let him cook it also Tahitian style. The meat was thoroughly washed and cut into convenient pieces; then these were placed on a layer of thick, green leaves that covered a pile of rocks which had been heating for some time. Another layer of leaves was laid over the meat and the whole covered with rocks. When supper-time arrived, we uncovered the mound and took out the appetizing food. After we had eaten the choicest of the best cooked portions, the remainder was carefully cut from the bones and rammed into three large, green bamboo joints, which were placed on the still hot rocks, covered again with leaves, and taken out the next morning, deliciously cooked, to furnish the party with rations for the next three days. Fireless cookers as fabricated by several American manufacturers may produce edible and economically cooked results, but for thoroughly toothsome and exquisitely flavored pork preparations, Tafia's cane and lava method is hard to excel.

Our next camp, built against a great overhanging bowlder and well roofed with the leaves of a mountain tuber, was not altogether proof against the tropical downpour that assailed us during our first night under it. First in one spot and then another the dripping drops would strike us: a shift of position would be made and then we would wait for the next assault. The little brook, twenty feet below us, that dropped in tiny rapids and waterfalls from one shallow pool to another, changed its placid murmur to a lusty rumble as it rolled rocks along its bed and poured downward the heavy volume of water that the cañon above was shedding.

A sunny morning cleared the water from the leaves, but our search for birds was again disappointing. Two or three swallows flying back and forth in the dark shade of a dozen orange trees, a couple of noisy broad-billed kingfishers flying out after insects instead of perching over the water to watch for finny prey, and companies of boisterous, rollicking minas (a robin-like species introduced from Australia) comprise the birds seen during the day. This negligible number of native birds in so seemingly favorable an environment was something new in my experience. One could hardly believe that the rats, which were such a pest in the lower parts of the island, had destroyed all the nests of certain native birds while permitting the imported minas and weaver birds to increase. It seems more likely that cats, running wild for a hundred years or more, may have exterminated three or four of the ground-loving species that were formerly found here.

As our guides had assured us they knew where shearwaters nested close under the cliffs near the highest peaks, we continued our march inland and upward. The trail led past well laden orange and lemon trees, growing singly and in groups, beneath which could be seen the tracks of wild pigs that had been looking for fallen fruit, although for the lemons they seemed to have no liking. We camped quite near the Diadem, one of the best known peaks of the island, and our camp here, at

2700 feet, was covered with leaves of the *fei* or wild banana plant which grew by the hundreds in the immediate vicinity. We noted less than a dozen ripe bunches of the fruit, and on inquiry we learned that the place was regularly visited and the bunches, containing about fifty bananas, each valued at ten francs, were taken and carried on poles down the ten-mile trail to the mouth of the cañon, where other means of conveyance was waiting.

A two days' search of mountain- and cliff-sides, where the rope, more than once, was necessary to the safety of the party, revealed only a dozen deserted burrows of the hoped for ocean birds, although one of the handsome, long-tailed tropic birds was flushed from an unapproachable hole in the cliffs.

Leaving our unprofitable camp under the Diadem, we hiked out again down a steep, sharp ridge into a little cañon leading into the main water-course which headed near by on the sides of Mt. Orohena, the highest peak in the Society Islands.

A band of wild pigs jumped out of canebrake in the bottom of the cool cañon close by the running water, but our guns, empty for safety's sake, did not hinder their hurried flight. Following down the brawling water, we soon came to a rock-bound waterfall; here it became necessary to scale the steep bank and climb out over a spur that ran down between the converging streams. We were surprised to find an acre or two of level land on top of the spur, and still more surprised to be told that the large rock-built square which we noted had formerly been a place where ceremonial dances and other impressive rites were performed. A more unlikely place from a present-day point of view would be hard to select, but when the mountains teemed with inhabitants, it may have been quite centrally located.

We skirted along the side of the spur and gradually dropped down into the main stream of the Punaruu; crossing it, we climbed up past a great clump of bamboo to an old camp site where we had a fine outlook over the greater part of the plateau below us.

Here our camp, built once more in the rain, was roofed over with the broad-fronded leaves of a heavy fern, thick clumps of which were scattered about in the underbrush. The next day one of us worked up from this point to the top of the ridge, while the other worked up the stream through canebrakes and along pig trails to the wildest part of the region. Neither of us saw other native birds than the dove, swallow, and kingfisher. To myself, returning to camp in the afternoon with a single dove after hours of hunting, the contrast between bird life on this island and that of another island in the same southern Pacific Ocean (Indefatigable, of the Galápagos group, where, with nothing but lava rocks thrown by hand, I had secured for food more than forty doves in two hours) was startling, even though easily explainable by the different conditions under which the birds lived.

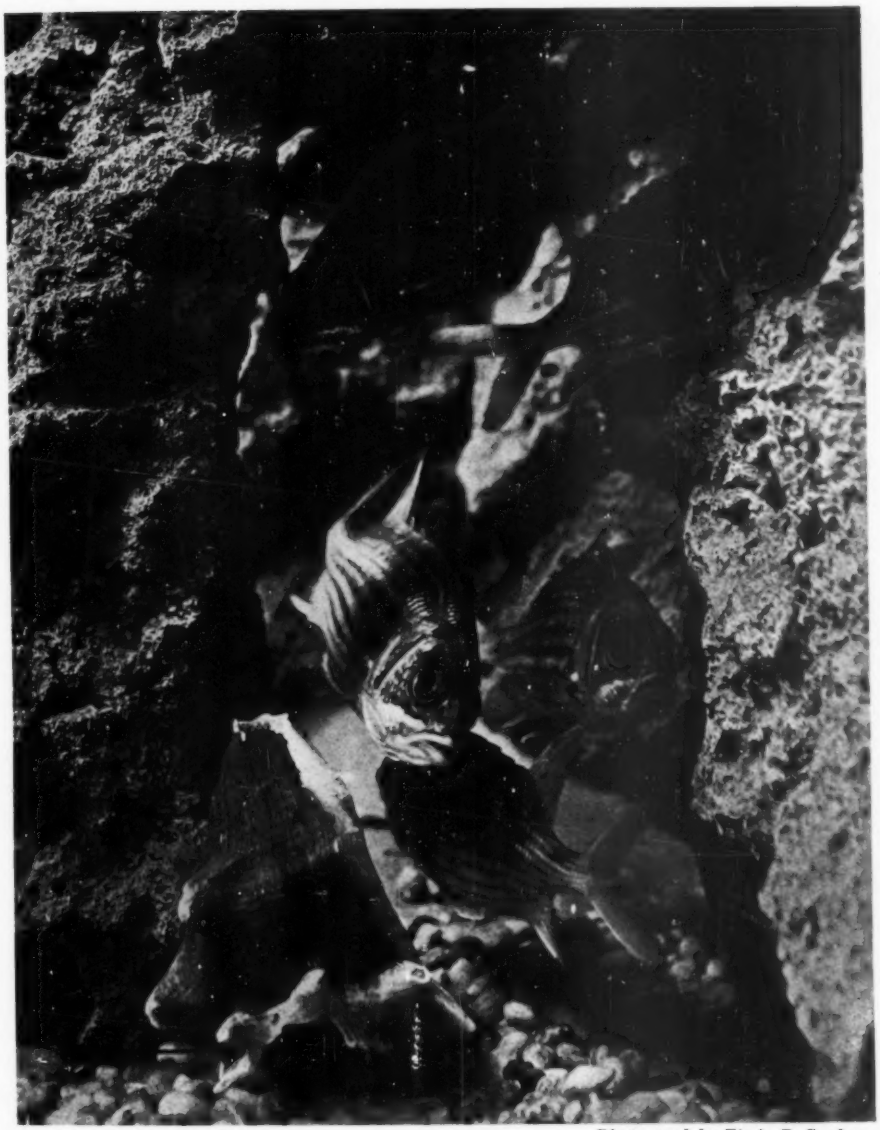
Having completed our reconnaissance of this section of the island, we packed up the next morning and started downward. We reached the motor road by the beach at five o'clock in the evening and our cottage somewhat later, as it was necessary to telephone from a plantation near by to Papeete for an automobile to run out for us.

To the ornithologist the trip was unsatisfactory, but to a lover of rough, tropical mountain scenery the same route can be highly recommended.

UNUSUAL PHOTOGRAPHS OF FISHES

BY ELWIN R. SANBORN

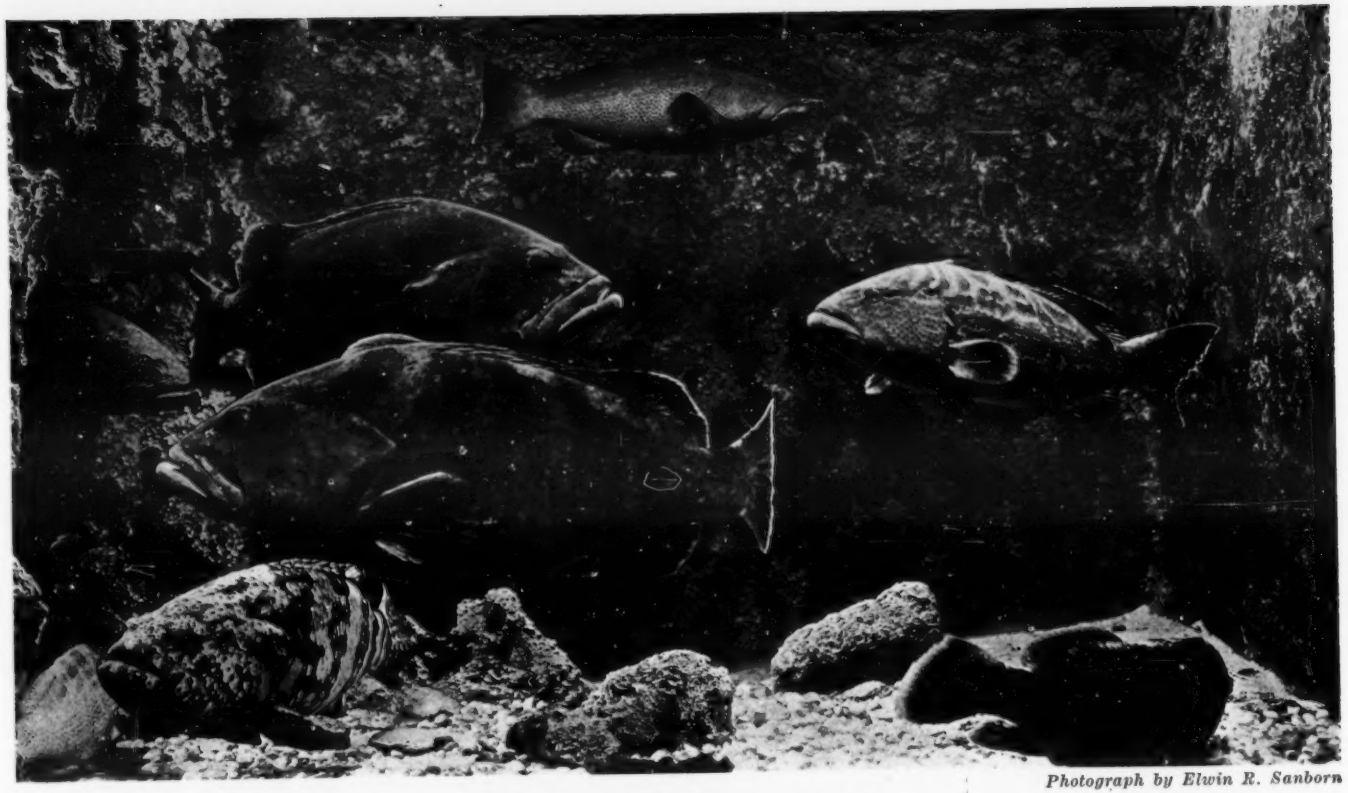
Photographer for the New York Zoölogical Society



Photograph by Elwin R. Sanborn

SQUIRREL FISHES

Obtaining satisfactory photographs of fishes under water, even in a tank, is a matter of great difficulty on account of the very unsatisfactory light. Mr. Sanborn has solved the problem in a series of beautiful pictures of the fishes at the New York Aquarium. Here we see a school of bright red squirrel fishes (*Holocentrus ascensionis*) hiding in a submarine crevice, just as they would be likely to do on their native tropical reef, until in the failing light of evening (approximating that to which their deeper-water relatives are accustomed) they come out in search of food



Photograph by Elwin R. Sanborn

ROCKFISH, GROUPERS, AND JEWFISH

The Serranidæ or sea bass family is represented southward by a great variety of species. Some of these, known as rockfish, groupers, and jewfish, reach a large size. The two big fellows in the picture are groupers (*Epinephelus*). The one resting on the bottom to the left is a spotted jewfish (*Promicrops*), a baby of its kind. There is a record of a jewfish of 400 pounds taken with rod and reel. To the right and above are rockfish (*Mycteroperca*). Such fishes are more or less solitary and sedentary in habit, although sometimes associated in considerable numbers about some favorite ledge down in the cool shadows under the blue-green water

Photograph by Elwin R. Sanborn

AN ASSEMBLAGE OF TROPICAL FISHES

Nowhere in the sea does one find such variety of fish life as about a tropical reef. This tank of fishes at the New York Aquarium will give some idea of conditions to be met with there. At the top of the picture in the center one can recognize the queen trigger fish (*Balistes vetula*). At the right a boldly banded spadefish (*Chaetodipterus faber*) stands out against the shadow. Immediately below it two or three porkfishes (*Anisotremus virginicus*) swimming close to the bottom are readily distinguished by their striking livery, banded in front and striped behind. In the center of the picture two pale-colored members of the Crevally family (*Caranx crysos*) are facing each other and the camera obliquely. Immediately below the left-hand one, the dark fish with a white mouth is one of the black angel fish (*Pomacanthus*). Above it is a grunt and above that two squirrel fish. On the bottom several rock hinds (*Epinephelus adscensionis*) are resting in the foreground. It is possible to pick out still other varieties, but a photograph, of course, gives little more than a suggestion of the beauty and variety of color in these forms

RAINBOW NATURAL BRIDGE LOOKING SOUTH--NAVAHO MOUNTAIN IN THE DISTANCE

Midway between the figure of the man at the left and the arch is an Indian prayer shrine—upright stones around a flat stone in the center—and a similar shrine is on the opposite side of the creek just beyond the dark rock in the central part of the picture

From Kayenta to Rainbow Bridge

By CHARLES L. BERNHEIMER

NOTE.—In the spring and summer of 1920 Mr. Bernheimer visited the little known Rainbow Bridge in southern Utah. In his letters he relates some of his experiences on the trip and describes briefly the natural beauties of the region as well as the difficulties and dangers attending the traveler who would journey through that rough and inhospitable country.

KITSIEL RUIN, Sagie Cañon, Arizona, May 17.—I wrote you yesterday before I left Kayenta for the journey to Rainbow Bridge. We made only fourteen miles that day,—eight by automobile, the remainder on horseback,—and slept last night at Laguna Creek in Sagie Cañon. The weather turned very cold and my woolen nightcap was much needed, but I awoke with the sun, crisp and lively as a young cricket.

We started at a quarter before eight this morning and rode until nearly three with only about an hour's intermission, during which we visited the Betatakin Ruins. They were wonderful! To do this we had to run into one of the many side cañons opening into the Sagie, entailing about five miles' extra travel, but I cannot tell you how glorious these intricate, lacerated arteries are, which sand storms, creeks, SLOWS and windstorms, frost and heat, have cut into this bleak part of the earth's crust.

We continued our ascent in the Sagie, then entered another side cañon and arrived at the foot of the Kitsiel Ruin, which in Navaho language means "much pottery." The valley is about one quarter of a mile wide, flat, but cut up by forty- to fifty-foot "washes" in which a confluent of Laguna Creek creeps. Such washes we had to cross dozens of times on our way here. We could not travel in the creek itself because of the many places in it which were jelly-like quicksand. To get to the Kitsiel Ruin I had to be helped by my three guides with a rope securely tied about my waist,—two of the men held the rope above and one climbed along with me, placing my feet. There was no risk whatever with the three experts watching over me, and the feat was worth all the trouble. I had to get down the "wash" of the creek, which here is about fifty feet deep, with the bank at an angle of 80 degrees,—practically perpendicular. This was a new experience. Johnson said: "Just sit down at the edge, dangle the legs over, the bank will break, and you will slide down with the sand as softly as if you were in a feather bed." I did, and it was a "peachy" yet novel toboggan slide.

The ruins are extraordinarily fine—equal to any of those at Mesa Verde. Some of the houses are in perfect condition. The finger marks of the builders, made more than one thousand years ago, are evident everywhere in the plaster or mortar. The cedar beams, the floors or roofs built of cedar, rushes bound in with willow branches, parts of woven baskets, are just as they were left when the people departed.

I have never fully described my outfit to you. There are eleven animals in all, six horses and five mules. My guides are John Wetherill, Ezekiel Johnson, and Al Smith, one of Wetherill's helpers, a nineteen-year-old, strong cow-puncher, cook, athlete, and general good all-round man. We have plenty of trouble with our animals, and there is a real western scene when they have to be rounded up, roped, and dragged at times when they become unusually

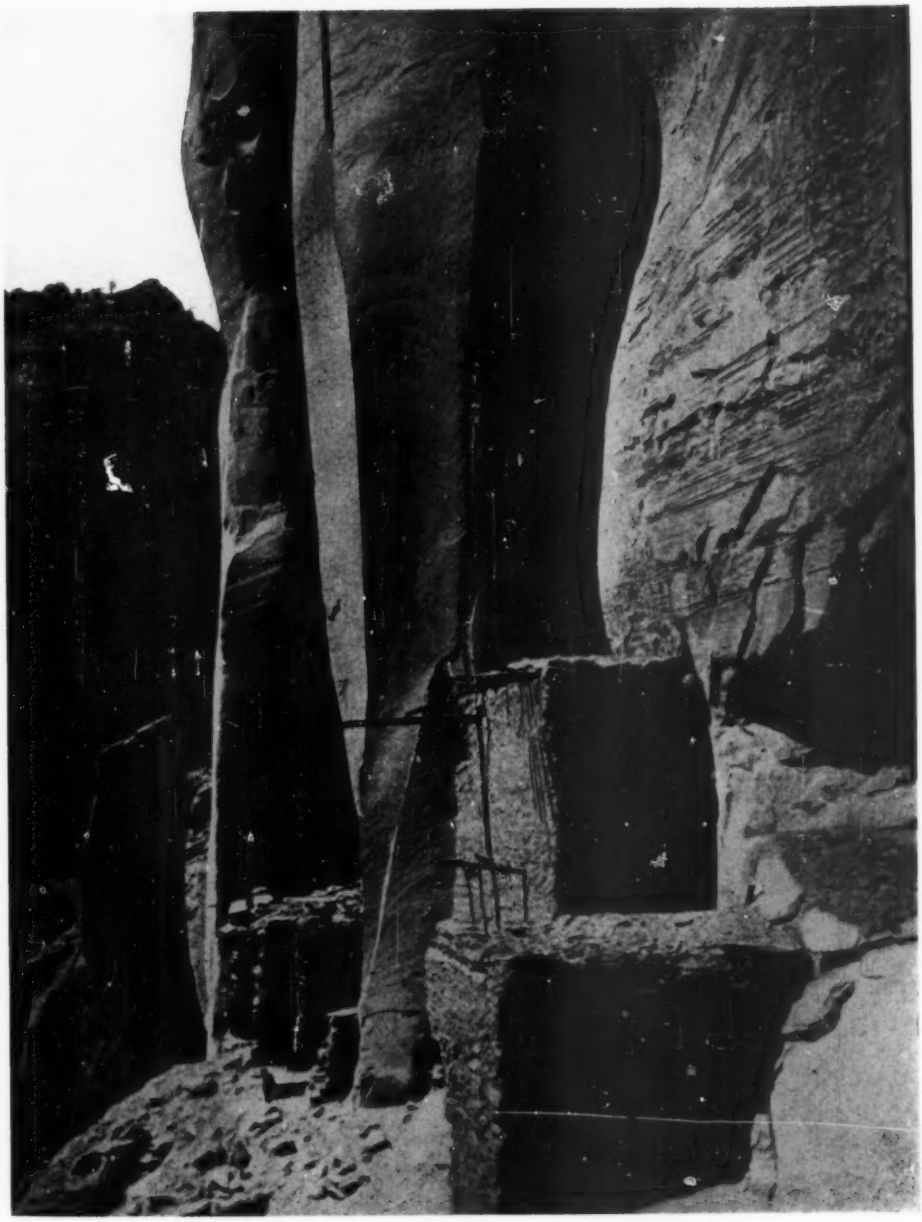
Center portion of Betatakin Ruins—one hundred feet above the bottom of the cañon. The beams and lumber are the remains of dwellings that have crumpled away

headstrong. The animals slip their loads very often by knocking against tree branches, rocks, and one another. At other times they lie down, load and all, preferably in a stream of water.

May 18.—After a more or less restless night we started from Kitsiel a little before eight on the way to Piute Cañon, which we hope to reach late this afternoon, and which we shall cross at the upper crossing tomorrow. After we climbed out of Laguna Cañon, much of our travel up to noon, when we stopped for lunch near Bubbling Spring, was over slick rocks. No doubt I shall use the words "slick rocks" often, and as these rocks are our chief trouble, I shall describe them. Winds and storms and sand blasts have cleared the rocks of all earth and polished them, and the horses slip easily on them; besides, they are of a limestone substance which, somewhat harder compared with the red sandstone generally met with, offers to the horses an insecure footing. The faithful brutes know this and it is pathetic to see how they watch their steps.

Evening.—We did not reach Piute Cañon. After making twenty-one miles since this morning we took advantage of a little cove in a mesa at the end of which Wetherill said there was a spring. The mouth of this cove was closed by sand dunes, which sooner or later will choke the little spring and kill, as they have already far progressed in doing, cedars and service-berry trees and scrub oak. Of course, by "spring" you must not understand the babbling kind,—it is merely a crevice in the rock out of which oozes a cupful of water every five minutes, which, if collected in pools near by, offers all we need. We named this spot "Hawk's Nest Cove," because of a hawk that was nesting above us. Hundreds of birds,—robins, bluebirds, and doves,—flew in at sundown to drink at the spring. The hawk did not have to go far for his supplies.

May 19.—We left camp this morning about eight o'clock and traveled the remaining five miles to Piute Cañon, walking down part of the way and leading our horses where the rocks were too



THE WESTERLY EDGE OF BETATAKIN RUINS

Emblem of the War God of the Navahos on the sandstone rock wall near the easterly end of Betatakin Ruins

helter-skelter for complete safety. On the other side of the cañon the ascent was similar, and we had to use all necessary precautions. That others had not done so was evidenced by the skeleton of a horse on a rock which our trail skirted.

We stopped on top of a low mesa in full sight of Navaho Mountain. Man and beast had to get along without water. Our lunch consisted of raw canned tomatoes (which are perfect thirst-quenchers when there is no water to be had), a can of pears, and some slices of stale bread. Late in the afternoon we began to climb Navaho Mountain, our intention being to stop from May 19 to 21 on a "bench" on its south slope about 1500 feet under its summit. The slope is covered with yellow pine, cedar, piñon pine, and quaking aspen. The mountain is 10,622 feet high and, you may remember, could well be seen from "Desert View," where we went by automobile from El Tovar on the Grand Cañon. Our camp was made near "War God Spring."

May 20.—This morning we started up the remaining 1500 feet,—we rode on horseback about 500 feet and then walked. The tramp or climb, at no time dangerous, was made exceedingly wearisome and trying by the fact that, unknown to Mr. Wetherill, the top of the mountain was covered with snow,—melting in rivulets and pools,—and almost every minute we waded and sank into snowdrifts above our knees and often up to our hips.

The view from the top of Navaho ex-

tends two hundred miles in all directions. We can see from there a great portion of four states, and the contrast from the desert floor to the slope of this noble mountain which is sacred to the Navahos and which they do not ever ascend, as they hold it in awe and believe it inhabited by one of their gods, is truly great. Because of the red rocks all over, the yellow desert sands, the sage flats and dark purple shadows, and the peculiar atmosphere, the panorama was a huge sunset-like expanse in rainbow colors. The sage brush of Arizona suddenly gives way to Oregon pine on the slope of Navaho. These fine, yellow pine trees here reach a height of two hundred feet and are often six feet in diameter and as straight as flagpoles, and the forests are virgin.

May 21.—We started this morning in the rain and toward noon came to country rougher and more picturesque. Surprise Valley is a real paradise. The approach to this marvelous little oasis is by a narrow cleft in the rocks. It cannot be reached from civilization by any other way, and the difficulties one must overcome to get there are unusual and most trying. For instance, we were one hour on whaleback, bare, slick rocks; at first sight it seemed impossible to cross them. Imagine smooth rocks, each a couple of acres in extent (exactly like a whale's back) which you must cross endlessly one after another. After these have been passed and just before one gets to the small, narrow gateway, there is a fiendish place to come down. How horses can do this I don't know, but our eleven animals did it safely.

May 22.—At noon sharp we reached Rainbow Bridge. I had often thought of it,—pictured it,—yet all my expectations are surpassed! It is more graceful, yet more powerful and more perfectly symmetrical than in any photographs I have ever seen, and it is worth all the trouble necessary to reach it. First the journey was merely an endurance test, but during the last two days it was all of that, plus skill (if I may use this word for myself) and instinctive ability on the part of the horse,—and fearlessness all around. The latter, after many days of preparation, becomes almost second nature.

The approach to the bridge,—that is, practically the entire nine or ten miles from Surprise Valley until the bridge is reached,—is a round of surprises. Bridge Cañon (which the Rainbow Bridge spans) is for several miles one continuous, awe-inspiring series of deep caverns. These concave places are about two hundred feet deep and three hundred feet at their openings, and when they occur on both sides, the effect is as though one were walking or riding in the inside of a sphere with but a slit left open above for the sky.

A more inspiring natural thing than the Rainbow Arch I have never seen, and it can be compared only with such wonders as the Grand Cañon. The dimensions are 309 feet in the clear from the bottom of the cañon and 277 feet from pier to pier! Its real name—in the Navaho language—is Nodzealid, which means rainbow. The Navaho name for Surprise Valley is Nasja, or in English, owl, and that was the name of the friendly Indian who first told Mrs. Wetherill of the existence of this place, which to the Indians is sacred, and no wonder. Mr. Wetherill, Professor Cummings, and a Mr. Douglas, under the former's leadership, got here in 1909. How they ever did it is a marvel of desert-craft, for the chances for mistakes, costly in time, fatal to provisions and horses and men, were ever present.

We are camping right under the arch of the Rainbow Bridge and the rock I am sitting on is directly under its keystone (if it has any). The air is warm and balmy, and desert flowers (mostly modifications of our home flowers) are all around me, growing out of the crevices in the rocks. Under

RAINBOW NATURAL BRIDGE LOOKING NORTH—BRIDGE CREEK BED IN THE FOREGROUND

Note the atmospheric conditions as illustrated by the fact that there is a distance of a quarter of a mile between the bulging rock in the foreground at the right and the one which appears to be directly behind it but which in reality is on the other side of the bridge. Compare with view of bridge looking south, page 552

the ledges of rock in the river bed we found the most beautiful maidenhair fern jardinières I ever saw; then we found a wild species of orchid (green and pink), and hanging on to one we found the nest of a humming bird. Upon looking into the nest (it was not bigger than a plum), we saw two little mouths open,—the baby humming birds had taken us for their parents; the little birds were each about as large as a bumblebee.

In this cañon there are more varieties of plants and flowers than are to be found between Asbury Park and New York City, and their blossoms are exquisite. There is, for instance, the yellow flowering, highly scented greasebush at my feet; it looks like a heather but is immeasurably more beautiful; there is the Indian paintbrush, a bright scarlet flower, so brilliant it can be seen two hundred feet away; there are acres of these, and no end of columbines, deep blue, light blue, and variegated, the beautiful but dreaded loco, daisies of all kinds, yuccas, purple wild asters, yellow sunflowers in profusion,—two scarlet spiked plants, one unnamed, the other called "standing cypress," while the cacti are simply dazzling,—orange, lemon, brick-red, baby-pink, magenta, and other colors, while the texture of the petals is as delicate as the film-like mull skirt of the *première danseuse* at the Grand Opera. The sago lily (Mariposa lily) found here grows in four colors and all intermediate shades,—they are white, golden, pink, and lavender (Mariposa is the Spanish word for butterfly, and they do look like butterflies). We passed the real purple sage yesterday. I cannot tell you how delighted I was to see it, for I really thought there was no such thing,—merely a poetic license. It is all different from the well-known desert sage. It has a blossom of deep royal purple of unusual intenseness; in the bright sun the blossom looks almost black. The horses love to browse on it. Our mute, intelligent animals are wonderful botanists,—they know exactly what is proper and wholesome food, and what to leave alone. And how sure-footed, fearless, and faithful! How impossible life would be in these trackless wastes and far reaches without them. That applies equally to the most low-bred Indian mustang. We have one they call "Bridget-Jack,"—a gray-bearded, hammer-headed, small animal. She is surly and difficult to handle, never seems to respond to kindness, but she is sure-footed and safe and attends to her duty, and carries, without a grunt, the heaviest load.

We have not been bothered by any insects excepting mosquitoes in our camp on the slope of Navaho Mountain, and their sting is not as venomous as that of the Jersey variety.

May 24.—We slept for a second night under the bridge and left for home today. Our load being lighter,—fodder and food having been consumed,—we could now travel more rapidly or in longer day marches.

May 25.—Our camp last night was on the northeast slope of Navaho Mountain. We had to trail around its rocky sides and finally at half past nine in the morning we reached the open, flat desert.

May 26.—We arrived at Kayenta at five o'clock in the afternoon, thus ending a delightful, happy, instructive expedition, which the good Almighty allowed to pass safely and without the least mishap.

THE MERMAID'S WINEGLASS, *Acetabulum crenulatum*, an exquisite green seaweed, photographed (natural size) soon after being taken from the waters of Biscayne Bay at Miami, Florida. This dainty plant is of occasional occurrence in shallow bays of Bermuda, southern Florida, and the West Indian islands. In Biscayne Bay it sometimes covers areas of considerable size to the exclusion of nearly all other kinds of marine vegetation. The elegant, radiately chambered cups are bright green when living, but they have a delicate coating of lime and they usually become chalky white soon after being gathered

Some Plants from Tropical Sea Gardens

By MARSHALL AVERY HOWE

Curator of the Museums and Herbarium of the New York Botanical Garden

A VISITOR from the north is often disappointed by his first sight of a tropical strand, which commonly shows little or no conspicuous vegetation between the tide lines. Particularly is this true if he is familiar with the rocky coasts of northern New England, where a large share of the richly abundant marine plant life is exposed freely to view with every ebbing tide. Probably the usual poverty of the strictly littoral marine flora in the tropics is due chiefly to the scorching effects of the tropical sunshine, although there are, of course, here as elsewhere, numerous more or less wide areas where a bottom of loose shifting sand, allowing no stable foothold or anchorage, precludes the development of any conspicuous vegetation.

But there are also extensive rocky shores, submerged reefs, and bottoms strewn with old corals or calcareous pebbles, where light, heat, aëration, and suitable anchorage combine to furnish ideal conditions for the development of marine gardens. If the observer can wade into such a place at low tide, especially on a calm morning before the daily trade wind arises to ruffle the surface of the water, the sight is one that is long to be remembered. Or perhaps he can row over it on one of the calm days such as occasionally occur in late spring or in summer, or can view it even in less placid weather from a glass-bottomed boat at some winter resort.

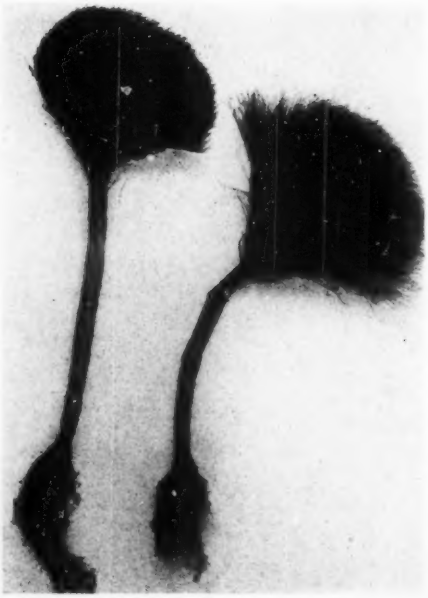
In addition to the graceful, often brilliantly colored or iridescent algæ—the plants proper—there are commonly also in such a garden stately corals and sea fans, which are colonial animals. These animals, because they are attached and have no more power of locomotion than a tree, are ordinarily looked upon as plants by the uninitiated. In fact, the "sea gardens" that are exhibited through glass-bottomed boats to patrons of southern winter resorts are sometimes almost exclusively "zoölogical gardens." Besides the colonial animals firmly attached to the home spot there are often also gaily colored tropical fish swimming in and out among the other organisms and giving a touch of active life to these submarine beauty spots.

Although the adjective "tropical" is used in our title and elsewhere in this discussion, the wealth of the marine vegetation in the subtropics of our North American coasts and adjacent islands is probably even greater than that of the tropics, strictly speaking. In respect to number and variety of species of "seaweeds" or algæ the richest areas in the northern half of the western hemisphere—at least the richest visited by the writer—would appear to be Bermuda, the Florida Keys, and the coast of California. It is possible, however, that Guadeloupe,[1] wholly within the tropics, deserves to be considered in this connection. Parts of the Bahamas, of Cuba, Jamaica, and Porto Rico, and of the Caribbean coasts of Panama are well supplied with marine algæ, but, taken as a whole, they do not give the collector the impression of wealth that he obtains from prowling about in the waters of the Florida Keys and Bermuda.

The "Sargasso Sea," in any such magnitude and character as was described by some of the early navigators and as was represented on some of the maps made only fifty years ago, seems to be more or less of a myth. Yet, floating mats[2] of *Sargassum*, several feet or, rarely, several rods in width are frequently met with, as one steams southward from New York or Halifax, or cruises about among the West Indian islands. Floating *Sargassum* is found particularly in the path of the Gulf Stream, which sometimes brings it far to the north, occasionally casting it ashore after

[1] The algal flora of this island has been intensively studied by French scientists and the list of marine species and varieties attributed to it reaches the imposing total of 811, a number considerably greater than that thus far attributed in any published paper to any of the three other regions. The determinations on which the Guadeloupe list is based are not altogether critical, however, and the sum total is swollen by the inclusion of numerous varietal or form names.

[2] These mats consist chiefly of two species, *Sargassum natans* and *S. fluitans*, which are certainly known only in a free floating condition.



THE MERMAN'S SHAVING BRUSH. *Penicillus capitatus*, from Bermuda. (About one half natural size)

a storm on Long Island, Martha's Vineyard, and Nantucket. As is well known, it is accompanied by a characteristic fauna of bryozoa, crustaceans, small mollusks, and the like, and fishes which go along with it to feed on the small animals that it carries. Species of *Sargassum* are difficult to limit and define, but it is safe to say that a dozen or more occur in the West Indian region. Most of these are surf plants, growing firmly attached to rocks and reefs in exposed places. They are found near the low-water mark, and, with their cousins of the genus *Turbinaria*, they take the place, in the south, of the northern rockweeds of the genera *Fucus* and *Ascophyllum*, both taxonomically and ecologically, although never so conspicuous and massive as the latter often are.

The genus *Sargassum*, like all the other algæ, belongs to the large group of plants known in the books as "thallophytes"—a group in which the plant body, according to the bookmakers, is not differentiated into root, stem, and leaf; yet it is very difficult, if not impossible, to frame a definition of a leaf which may not apply to the leaflike structures shown by the species of *Sargassum*. In other words, a *Sargassum* is a "leafless" plant that appears to have leaves.

The larger algæ are divided into three great groups, which are often spoken of in an untechnical way as the "greens," the "browns," and the "reds," these names being abbreviated translations of the technical group names, which have been based upon the prevalent colors shown by representatives of these groups. The "browns" include the largest kinds of seaweeds, such as the kelps and rockweeds of the North Atlantic and the giant kelps of our Pacific coast, individuals of which often reach a length of more than one hundred feet and the extensive beds of which are now being used as a source of potash for the American farmer and gardener. In the American tropics, the more conspicuous members of the brown group include, besides *Sargassum* and *Turbinaria*, already mentioned, representatives of several other genera.

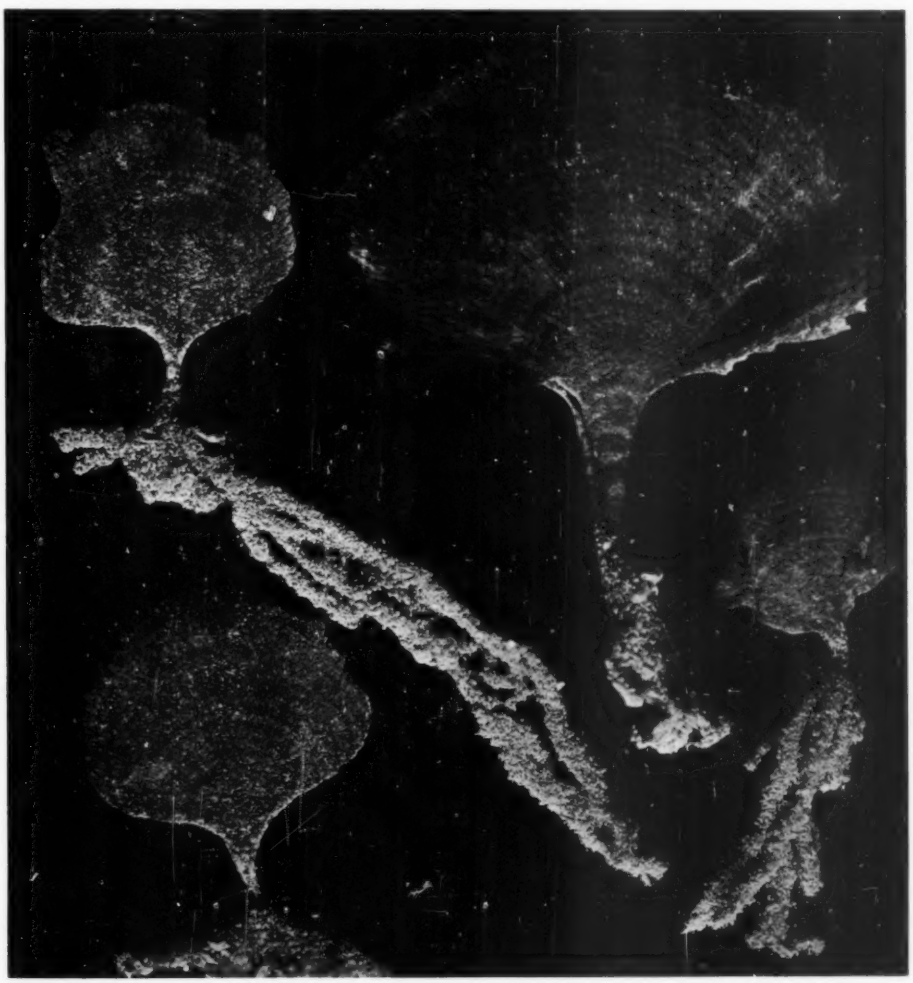
It is perhaps in the large group of algæ known colloquially as the "greens" that one finds the most interesting and curious as well as the most beautiful of the tropical sea plants. In these, the leaf-green or chlorophyll, characteristic of plants in general, is found essentially free from admixture with other pigments. In many of them, however, the plant body is more or less coated or permeated with lime, so that it is often whitish, at least in the older parts, or speedily becomes so after being taken from the water and exposed to the light.

Of the group of calcified green algæ the four species of *Penicillus*, indigenous to the sea bottoms of Bermuda, southern Florida, and the West Indies, are among the most curious. In these, as is suggested by the Latin name, the plant body takes the form of a brush, its component filaments being closely interwoven to make a cylindric or flattened stalk and then, at the top, set free and forking, each enclosed in a porous sheath of lime, they constitute the head or bristles of the brush. One sort, perhaps the commonest, is sometimes known as the merman's shaving brush, or is occasionally referred to by the less particular and meticulous as the mermaid's shaving brush.

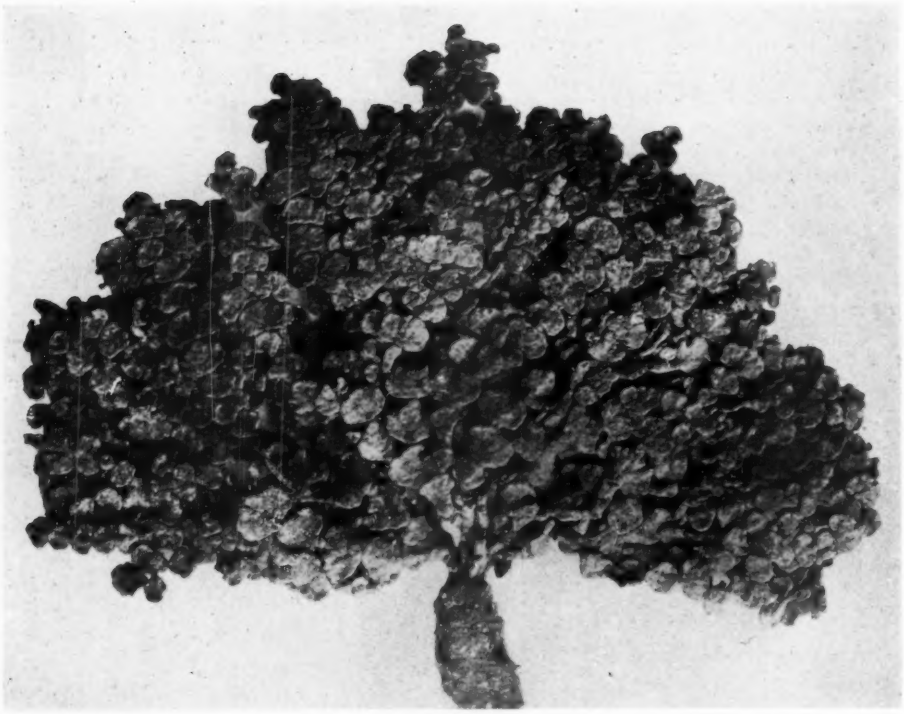
A relative of the plant just described and one that grows in similar situations is the mermaid's fan. There are several species of this generic group (*Udotea*), in all of

which the delicate root hairs penetrate the calcareous sand and attach to themselves small particles of this sand, thus making anchorage hawsers in a bottom that is not altogether stable. The rootlike part, in the attached algæ, is supposed to serve simply as a holdfast. These sea plants often affix themselves to smooth hard rock, or sometimes to pieces of iron or glass, from which they can evidently draw little or nothing in the way of nourishment. Their food is apparently derived directly from the surrounding water and air and is taken in directly by the general surface of the plant. In the case of these Udoteas and their relatives, however, with their highly developed systems of sand-burrowing rhizoids, it may be suspected that these rhizoids play a part in the gathering of food as well as in anchoring the plant. What are commonly called "sea fans" by frequenters of the sea are organisms of a very different nature from those here described under the name of mermaid's fan. They are larger and are colonial animals related to the corals.

Another interesting and attractive member of the group of lime-coated green algæ is the sea fir (*Rhipocephalus phœnix*), the center of whose distribution appears to be the Bahama Banks. This plant is usually from two to six inches high and when growing on the sea bottom is very suggestive of the little German Christmas trees that were



THE MERMAID'S FAN, *Udotea conglutina*, from Bimini Harbor, Bahama Islands. (Natural size)



A CALCIFIED AND SEGMENTED GREEN SEAWEED, *Halimeda simulans*, from Porto Rico. (About four fifths natural size)

once sold in this country for holiday decorations. It is dark green when living but is soon bleached to a chalky white after being killed and exposed to the light. In general structure, it is somewhat intermediate between the brushes and the fans, being brushlike in general habit but having numerous small overlapping fans for branches.

The writer once enjoyed the privilege of being becalmed for two days on the Bahama Banks in a small sloop. On these banks are hundreds of square miles where the water is mostly from one to twenty feet deep. The bottom here is chiefly of more or less compacted oölitic sand, consisting of clean white nearly spherical granules that suggest fish roe both in form and size. Such a bottom rarely becomes muddy to any appreciable extent and the waters above it are wonderfully clear, so much so that when a breathless calm makes the surface of mirror-like smoothness one can see the vegetation and animal life of the sea bottom in twelve or twenty feet of water almost as distinctly as if the water were only two feet deep. On wide areas of the Bahama Banks the merman's shaving brushes, the mermaid's fans, the sea firs, and their relatives are the dominant features of the marine flora, sometimes forming a continuous carpet on the floor of the sea.

Prominent among the relatives of the Udoteas are eight or ten kinds of *Halimeda*, in all of which the calcified plant body is regularly jointed or segmented. In most of the species of this genus the lime is abundant and the system of joints gives a certain degree of flexibility to a plant that would otherwise be quite rigid and stonelike. One of the species, at least, sometimes occurs in great masses, and the quantities of lime left by its decay are, in places, important factors in reef building and land forming. The fact that it is a more rapid grower than the corals seems to give it a certain advantage over them in the matter of secreting and depositing lime, even though the proportion of lime in its make-up is not so great.

Perhaps the most dainty and exquisite of the green algæ is the mermaid's wineglass, *Acetabulum crenulatum*, which grows in shallow bays and protected places, ranging

as far north as Bermuda and southern Florida. It is rarely found in any great quantity, yet occurs in considerable abundance on old shells and pebbles, mostly in ten or fifteen feet of water or less, in the bays lying between the keys and mainland of southern Florida. The actual height of the plants is usually from two to four inches. The elegant cup-shaped disk which surmounts the graceful stalk is largely reproductive in function, each of its radial chambers containing at maturity, in the present species, from 200 to 500 subglobose, firm-walled spores, scarcely visible to the unaided eye, each of which produces on germination a number of smaller motile cells which are sexual in nature. At least three other species of this genus occur in the West Indian region.

Among the larger green seaweeds of the warmer parts of the earth are some that are not calcified and of these the species of *Caulerpa*—a dozen or more of them in Bermuda, southern Florida, and the West Indies—deserve especial mention. These present themselves in a great variety of graceful and attractive forms, some of them suggesting delicate feathers, others looking like clusters of green grapes, the inflorescence of grasses, the twigs of cypress trees, or sprays of running pine. They are found in tide pools, on the roots of the red mangrove in lagoons, and creeping on the sea bottom down to a depth of a hundred feet or more. Individual plants of some of the kinds get to be four or five feet long. A curious thing about them is that, although they are plants of considerable size, no one has yet certainly detected in them any spores or other special reproductive organs. They seem to maintain themselves by simply continuing to grow at one end while dying off at the other, or to propagate their kind by accidentally detached fragments. It nevertheless seems probable that they produce some sort of minute reproductive cells which have thus far escaped observation and detailed description. Doubtless much remains to be learned about the life history of the Caulerpas and many of their relatives by some one so situated that he can watch the living plants continuously throughout the year, with a compound microscope and needed accessories at hand.

A species of *Valonia*, taking the form of a

A GREEN SEAWEED, *Caulerpa racemosa*, that suggests bunches of grapes, photographed (not in place) at the mouth of the Guánica Harbor, Porto Rico. (About one half natural size)

balloon or an irregularly oval sac, ranging in size from the dimensions of a robin's egg to those of a hen's egg, and filled with a fluid protoplasm, is often found washed up on beaches in the West Indian region and is, in Bermuda at least, often referred to as "sea bottles." Dark green and iridescent in life, it becomes clear and translucent after being killed and exposed to the light for a time and may be as attractive then as when living. Children sometimes pick it up on the beaches and by skilfully exerted pressure playfully squirt the liquid contents into each other's faces. These little "bottles" grow in shallow water mixed in with seaweeds of the soft mossy kinds or under shelving rocks near the low-water line. Another kind of *Valonia*, consisting of somewhat smaller ovoid or bottle-shaped segments that branch and cohere in large masses, is often beautifully iridescent and very attractive when seen growing in the water.

It is in the large group of marine plants known nontechnically as the red algæ that we find the greatest variety in the tropics, although as individuals the "reds" are rarely so numerous or so conspicuous as are many of the "browns" and "greens." Many of the most interesting and beautiful of the "reds" are so small that their wondrous symmetry and beauty are revealed only to the user of a hand lens or a compound microscope. Several are so delicate or have such a soft gelatinous texture that when floated out on paper and dried under pressure they adhere so closely to the paper and have so little substance that they are sometimes taken for paintings by those who do not stop to realize that no human hand could trace lines of such delicacy and symmetry as these "flowers of the sea" often possess. One of the coarser red seaweeds of the tropics, *Bryothamnium triquetrum*, looks a little more like some land plants. The main axes have three rows of short toothed or fringed branchlets, giving these axes a three-angled or three-winged effect. The individual plants form dense clumps one or two feet in thickness, but they sometimes grow associated in large numbers, forming extensive beds.

The red algæ, like the greens and the browns, contain chlorophyll, the green color substance common to plants in general, but they have also another pigment that modifies or obscures the green, so that the plants appear to be of some shade of red, pink, or purple, or sometimes almost black. The red pigment is soluble in fresh water, and the green is not, so that red seaweeds washed up on the beach and exposed to rain often become green or show zones or spots of green in the more exposed parts. On the other hand, the green is soluble in alcohol while the red is not, so that the two pigments may be easily separated. The red algæ that are really and strikingly red are, with few exceptions, inhabitants of deeper water than the greens and the browns and are usually collected by dredging—or by being found washed ashore, particularly after a storm.

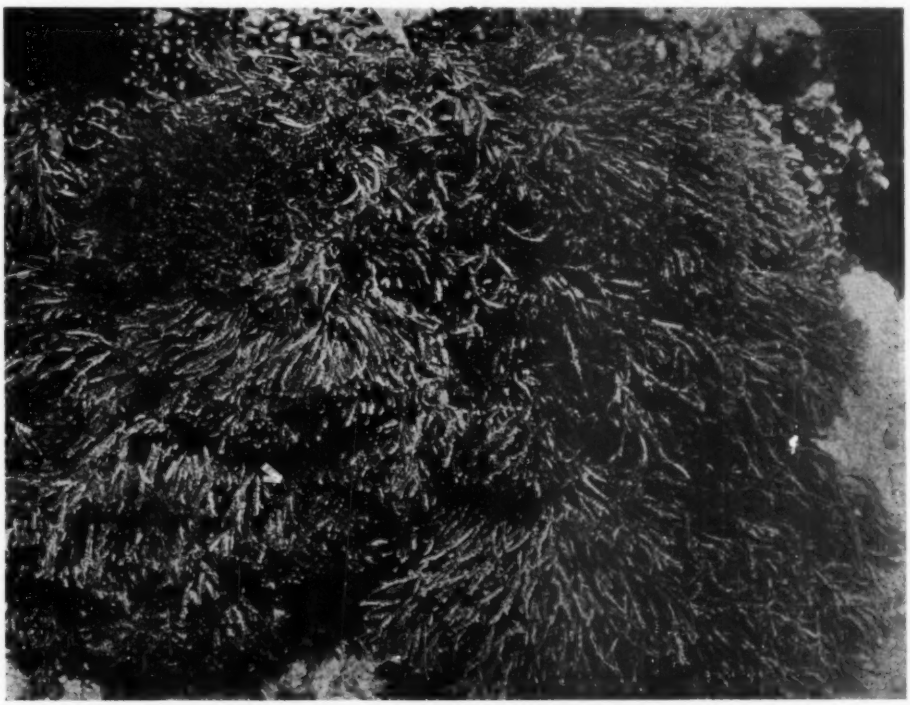
Several kinds of red algæ as well as of "browns" are extensively used by the Chinese and Japanese as articles of food.[1] The agar-agar of commerce, derived from red algæ, is a food in the Orient, but is known in America best as a nutrient medium for laboratory cultures of bacteria and fungi. Another product of red seaweeds, known as "funori," is manufactured by the Japanese to the amount of two or three million pounds a year and is used by them for sizing for cloth, for which purpose it seems to have certain advantages over starch. Most of these marine algæ from which the Japanese derive products that sell for several millions of dollars a year have close relatives in American waters, but apart from the recent development of the kelp potash industry in California and the use of seaweeds as a fertilizer for the land by farmers living in the vicinity of the sea, the inhabitants of the United States have thus far made little practical use of the plant life of the ocean.

On the coast of Massachusetts the Irish moss or carrageen (*Chondrus crispus*) used for making sea-moss jellies or puddings, is collected to the value of a few thousand dollars a year, and the "dulse" (*Rhodymenia palmata*), which is eaten raw as a sort of salad or relish, is gathered in still smaller quantities and offered for sale

[1] See paper, by the writer, on "Some Economic Uses and Possibilities of the Seaweeds." *Journal of the New York Botanical Garden*, XVIII, 1917, pp. 1–15.

in the water-front markets of New York and Boston. But with the increase of the population of our country, and with the certain advance of science and its applications, it is probable that the future will witness a widely extended utilization of the plant resources of the sea.

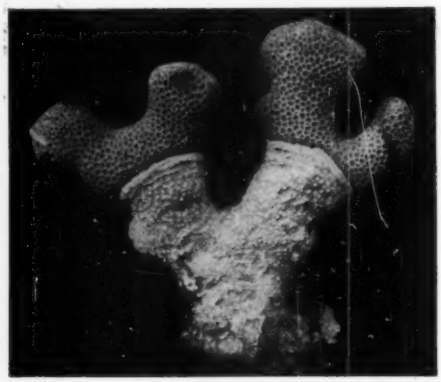
In at least three of the natural families of the red algæ the plant body takes up lime from the sea water and becomes more or less hard and stonelike. In one of these families in particular (the Corallinaceæ, so called on account of a superficial resemblance to the corals) the plant, except for the inconspicuous reproductive cells and almost equally inconspicuous apical or superficial layers of new tissue, is almost as hard as any limestone rock. It has become apparent in recent years that in many parts of the world these lime-secreting sea plants are and have been an important factor in the building of reefs, a line of activity that in the past has been attributed almost exclusively to the coral animals, even though, as would now appear, these coral animals are often of secondary importance. But the coral-like seaweeds are always plants, however coral-like they may look. In microscopic structure and modes of reproduction they are just as truly plants as are any of the seaweeds of the soft mossy kinds. Yet it is not at all surprising that those who have not studied such things sometimes confuse these hard stonelike plants with the corals and that even the naturalists of a hundred years ago often did likewise.



A LARGE RED SEAWEED, *Bryothamnium triquetrum*, of the American tropics and subtropics, photographed (not in place) at the mouth of Guánica Harbor, Porto Rico. (About one third natural size.) At Key West, Florida, this species forms large mats on the floor of the ocean, mostly at a depth of from twenty to fifty feet

The lime-secreting plant often forms a crust that gradually creeps over, covers, and smothers coral animals. Plant crusts of these kinds are usually small and thin and are probably of not much importance in building reefs. But there are many different kinds of these hard lime-secreting plants and some of them occur in large masses and form extensive reefs. Certain species are of a delicate pink color, so that one may easily imagine what an attractive

ONE OF THE STONY, LIME-SECRETING CORAL-LIKE SEA PLANTS, *Goniolithon strictum*, from Key West, Florida. (About one half natural size)



AN ENCRUSTING SEAWEED, *Goniolithon solubile*, growing on a living coral, from Porto Rico. (About two thirds natural size.) The lime-secreting plant is conquering the lime-secreting colonial animal, gradually covering and smothering the coral polyps

display a reef must make when exposed, or even when visible through calm water.

There are coralline algæ which grow attached to the shells of members of the clam or mussel family. The intimate attachment is probably unwelcome to the clam, although the overshadowing presence of the shrubby stonelike alga may render the clam a service by covering and protecting it from some of its enemies. The algæ in general are not very particular as to their points of attachment, although something substantial and firm in the way of a substratum seems usually to be preferred.

Living corals are found only in the warmer seas; coral-like plants occur not only in the tropics, but also in temperate and frigid waters. Explorers in the Arctic regions have reported great beds of them on the floor of the ocean, mostly in water that is from 60 to 120 feet deep.

A few years ago the Royal Society of London sent a party of naturalists to the South Pacific to study the mode of origin of the so-called coral islands. The island of Funafuti of the Ellice Islands group was chosen for special study because it was believed to be "a true coral island." By means of a drill, borings were made to a depth of a little more than 1100 feet, the cores brought up were carefully studied, and the various groups of animals and plants that had contributed to the upbuilding of this island were ranked in order of their relative importance. The first rank was given to red algæ of the coralline family; the second to lime-secreting green algæ of the genus *Halimeda;* third rank was awarded to the group of microscopic animals known as Foraminifera; and fourth rank to the corals. So Funafuti seems to be "a true coral island" which, strictly speaking, is not a coral island at all!

American geologists are finding evidence that certain limestones, now high and dry, in various parts of the United States and the West Indies, are made up chiefly of the remains of lime-fixing plants that flourished when those parts of the earth's crust were under the surface of the sea. So these hard limy sea plants, living and dying century after century and rising "on stepping-stones of their dead selves," are not only making land today, but their ancestors and relatives did the same thing thousands of years ago.[1] And no small part of the pleasure and satisfaction of exploring the sea gardens of the tropics comes from observing bits of evidence as to how this great work is still being accomplished.

[1] For a further discussion of this subject, see a paper by the writer on "The Building of Coral Reefs." *Science*, XXXV, No. 909, May 31, 1912, pp. 837–42.

The Sacred Bundles of the Pawnee

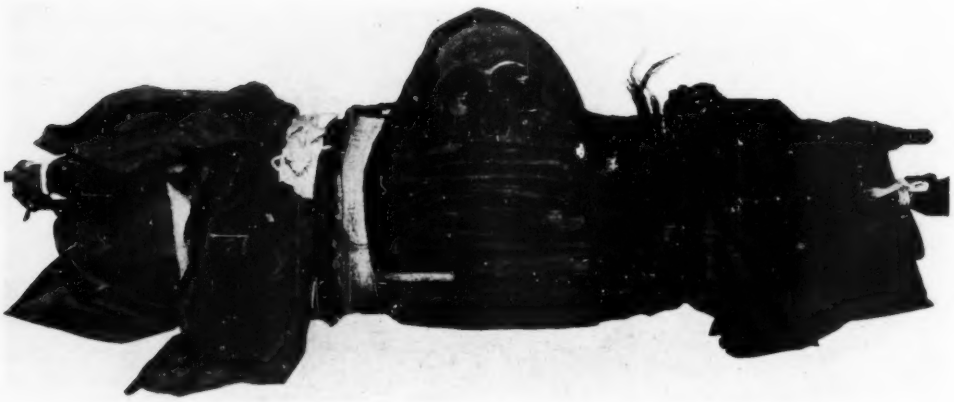
By CLARK WISSLER

THE exhibit of the Plains Indians in the American Museum has been enriched by the display of sacred bundles from the Pawnee. These are in themselves uninspiring objects, but when we once come into some understanding as to their meaning and the place they occupied in the beliefs and philosophy of the original Pawnee, their true significance begins to dawn upon us. Here you may stand and look at leisure upon objects associated with the most sacred and noble thoughts the great Pawnee tribe was able to produce. Such objects are a rarity in museum collections, for they are the greatest of tribal treasures.

We speak of them as medicine bundles, but it is well to note that "medicine" and "medicine bundle" are terms frequently heard when speaking of our Indian tribes. Unfortunately, the word "medicine" carries with it an erroneous interpretation, for the Indian's medicine is not medicine at all. In most cases the Indians draw as sharp a distinction between doctors and priests as we do, and it is rare that both the doctor and the priest take part in the same ceremony, for they more often than not hold each other in contempt. Thus, among the Pawnee, the priests pray to the gods in the heavens, but the doctors pray to the powers in the animals and the waters. The priest is therefore the exponent of the most sacred and highest culture of the Pawnee. This has its analogies in the social life of many other tribes, so we may accept the generalization that most of the Indians within the bounds of these United States clearly distinguish between the functions of a doctor and a priest.

Such a distinction seems self-evident to us; yet, when our forefathers first came in contact with Indian life, they failed to see any distinction between the native doctor and the priest and were so impressed with the functions of the latter, whom they called a medicine man, that they applied the term to all priests and conductors of ceremonies, and likewise used the term "medicine" as a generic term for all objects used in social functions and religious ceremonies, as well as those used in treating the sick. So we have the term "medicine bundle" so firmly fixed in our literature that it must be retained, but these rare bundles from the Pawnee have no relation to drugs or charms for healing the sick. They are in fact symbolic of a series of rituals in which is crystallized the Pawnee philosophy of the universe. The bundles, therefore, are valued solely because of their association with these rituals, for the rituals, or rather the ideas they formalize, are the realities in the mind of a Pawnee.

Again, each of these tribal bundles is associated with a social function, or office. There is, in fact, a yearly cycle of rituals governing the tribal activities of the Pawnee, for each important unit of which there is a bundle, and the priest, or keeper, of this bundle is for the time the leader or director of the people. Thus, the opening of the year is the spring when thunder showers occur. In fact, when the first thunder is heard in the spring, the priest of the leading bundle begins the demonstration of the most fundamental rituals, the creation of the world and life. The bundle used in this ceremony, wrapped in the tawny skin of a buffalo calf so tied as to represent that animal, is known as the "Yellow Calf." Yet the ritual indicates that this bundle gets its sanction from Venus, or the Evening Star Goddess, who in Pawnee belief is the grandmother of man, as well as the

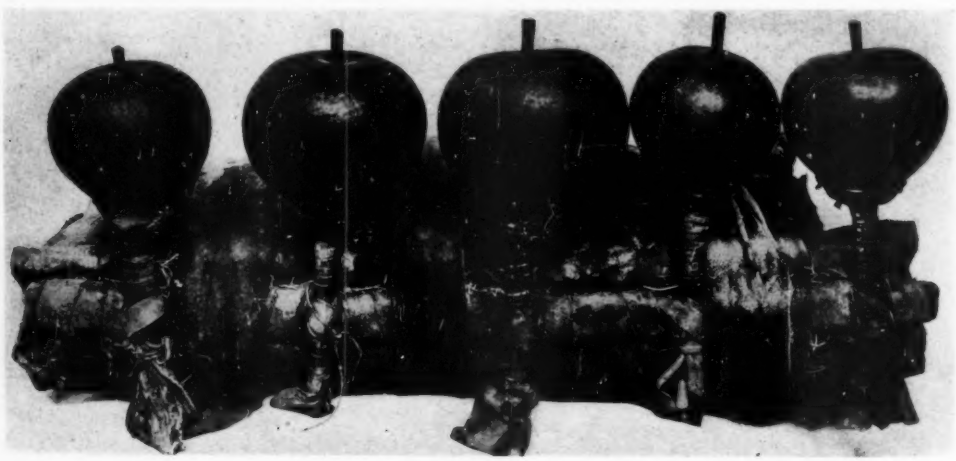


The Pawnee believe that the bundle of the skull descended from the first man. Its priest gives the order for preparing the fields and planting the corn. The women of the tribe do most of the work in the fields and gardens

giver of life to most living beings. This bundle of the Evening Star is, therefore, the highest of Pawnee bundles and, in consequence, the most interesting in the whole collection. It is doubtful if there is any single object in this or any other museum that makes so strong a claim to distinction. That it is here and that the full account of its ritual is on file in this Museum is due to the interest of Mr. James R. Murie, the present hereditary chief of the Skidi Pawnee.

Many peoples, ancient and modern, have looked upon fire as one of the fundamental gifts of the gods. Hence, it is not strange that one important feature of the Evening Star bundle is a set of fire sticks with which the grand high priest of the Pawnee kindled the "new fire" for the new year. The idea underlying all the ceremonies with this bundle is the renewal of life manifest every spring. This is taken as a demonstration by the gods of the story of creation; hence, it is proper that the people have a formal recital of the initial events in the creation of the world, and that fire and everything else of importance produced by human agency be symbolically renewed.

Yet, the most significant object in



A very striking bundle is that of the Kitkahaki Pawnee. Fastened to the outer cover are five large gourd rattles, a pipe, a wooden swordlike object, and some arrows

this bundle is the sacred ear of corn. The greatest blessings the Evening Star Goddess conferred upon mankind were buffalo and corn. The teaching is that she placed upon the earth a bundle consisting of the germs of corn closely wrapped in a buffalo calf skin, and as the corn plants burst forth, the skin wrappings arose as a living buffalo. Hence, this bundle is spoken of as the "Yellow Calf," and the sacred ear of corn kept inside as "Our Corn Mother."

We have not the space here to recount the beautiful procedure in which the grand high priest ceremonially plants the seed of the sacred ear and how, at the harvest, he goes in procession to the fields to select the sacred offspring which he conducts ceremonially to its new home in the Evening Star bundle.

Of other objects in the bundle we may mention the sacred pipe with its cloud symbols representing the gods in the west, an arrow-straightener made of antler, and scalps from the heads of enemies. Each of these has its own symbolic setting in the ritual.

Another bundle of almost equal interest is the skull bundle, upon the top of which is a human skull. The belief is that the ritual for this bundle came down from the first man and that when he died his skull was placed upon the bundle. This is not the original skull, however, for there is a tradition that a woman once dropped a tipi pole upon the original, smashing it into fragments, and that the skull of a famous chief was substituted. This must have been many years ago, as the skull is blackened with age.

On the outside of the bundle are a sacred bow with three arrows and two pipestems. Inside are many objects, the sacred ears of corn, the sacred pipe, fragments of the holy otter collar worn by a war leader, the arrow-straightener, paints, and tobacco.

The ritual for this bundle presides over the planting of corn, and its priest gives the order when and how the fields are to be prepared and the grain planted. Since the women are the chief gardeners, they take the leading rôles in the more spectacular parts of these ceremonies.

In addition to these two very remarkable Skidi bundles we have tribal bundles for the Kitkahaki and Chaui divisions. Of these, the Kitkahaki is the more striking. Fastened permanently to its outer cover are five large gourd rattles. Within this wrapping is the bundle made up in a woven bag, containing sacred ears of corn, a sacred pipe, an arrow-straightener, paints, and other objects. Attached to the outer cover are a pipe, a wooden swordlike object, and some sacred arrows.

The Chaui bundle is wrapped in buffalo skin, on the outside of which appear a raccoon skin, sacred arrows, a stick for stirring soup, a wooden paddle, and a swordlike object. Within the bundle are a shoulder-blade hoe, the usual sacred corn, an arrow-straightener, and fresh-water mussel shells for mixing paints.

Besides these four great tribal bundles there are in the collection a number of smaller war bundles. These usually are spoken of as "meteor bundles" because it is believed they contain meteorites, objects looked upon as children of Tirawahat, the supreme god.

This collection is the best series of religious objects on exhibition in the American Museum; yet its value rests not in the possession of the mere objects, for they are commonplace, but, in the manuscript accounts covering each detail of the rituals for these bundles, we have the knowledge as to what these objects symbolized in the thoughts of the Pawnee. Other tribes had bundles, and examples of them frequently find their way to museums, but seldom is there satisfactory knowledge as to their significance. Thanks to Chief James R. Murie, we can look upon at least one set of tribal bundles and see them in something of their true light.

Slabsides, John Burroughs' rustic cabin near West Park, New York

The Optimistic Philosophy of a Naturalist

By G. CLYDE FISHER

Associate Curator of the Department of Public Education, American Museum

JOHN BURROUGHS is not and never has been a preacher. His is not the theological type of mind, but the interpretive type, and in his latest book, *Accepting the Universe*,[1] he does not turn from his literary habit of more than half a century. While this volume is a collection of religious essays, we know our veteran naturalist writes "not to preach, or to convert, or to dogmatize," but to interpret.

There are thousands of lovers of John Burroughs who will be grateful for this book,—who will be keenly interested in what this exponent of the simple life has to say,

[1] *Accepting the Universe*, by John Burroughs. Boston: The Houghton Mifflin Company. 1920.

at eighty-three, about "The Faith of a Naturalist." It is a robust faith. The strictly orthodox reader may dissent from many statements, but all must admit that John Burroughs is a tireless searcher after truth and that he stands reverent and humble in the face of the eternal verities.

The breadth of treatment is suggested by the following quotation: "Were not Darwin, Huxley, Tyndall and Lyell, and all other seekers and verifiers of natural truth among the most truly religious of men? Any of these men would have gone to hell for the truth—not the truth of creeds and rituals, but the truth as it exists in the councils of the Eternal, and as it is written in the laws of matter and of life.

"For my part I had a thousand times rather have Huxley's religion than that of the bishops who sought to discredit him; or Bruno's than that of the church that burnt him."

This production, coming from a naturalist philosopher who really belongs to a former generation, is naturally compared with his earlier books, and in the comparison we are not disappointed, for, judged by the most critical standards, we find it as fresh and as clear as *Wake-Robin* and *Winter Sunshine*. It is written in that charming, unobtrusive style which characterizes all of Mr. Burroughs' essays from those penned while Abraham Lincoln was President of these United States, down to those of the present time.

The only essays of this author, however, which can be closely compared with the collection, *Accepting the Universe*, are those in the volume so appropriately entitled *The Light of Day*, published a score of years ago, a part of those in *The Breath of Life*, and an occasional one in a few of his other volumes. The essays in his latest book are possibly a little more ripe. They are certainly marked by an abiding confidence that whatever is, is right, that this is the best possible world; in short, they are permeated—and this is significant—with a thoroughgoing optimism.

The Proofs of the Evolution of Man

Scientific evidence would indicate that the human race came from small tree-dwelling ancestors in Central Asia

By W. D. MATTHEW

Curator of Vertebrate Palæontology, American Museum of Natural History

THE chief interest of evolution to everyone, the only interest to the "average man," is its bearing on our own ancestry. Mention Darwin to a casual acquaintance, and he immediately thinks of monkeys, and whether or not he is descended from one. Generally he prefers not to be and therefore concludes that he isn't. Even the better informed members of the community, who have read enough and thought enough on this subject to know that this is not quite a correct or complete statement of the Darwinian theory, still consider it as chiefly concerned with the ancestry of our own race. And so perhaps it is from a humanistic point of view. Our own history is after all a deal more interesting to us than other people's. And it is quite proper that scientists, as well as the rest of the world, should give more consideration and discussion to the problems of man's evolution than to any other phase of the subject. Certainly they do so. Every new bit of evidence regarding the ancestry, near or remote, of our species, every new interpretation of facts already at hand, attracts an interest denied to evidence or theories which concern the evolution of the lower animals. A discovery of fossil man, or of prehuman "hominids" as man's immediate extinct relatives have been called, is chronicled and discussed far and wide, not only in scientific journals, but also, and at almost equal length, in the newspapers and popular magazines. Its genuineness is subjected to the most severe scrutiny. Its significance is set forth with a varying degree of pardonable exaggeration by enthusiastic writers, scientific and popular. Criticisms no less vigorous appear in abundance, some based upon a well-informed and conservative judgment of the facts, most of them, one regrets to say, reflecting merely a reluctance to accept evidence that conflicts with accepted theories, and a disposition to minimize its importance and validity.

The interest that attaches to this phase of evolution has been recently illustrated at the Birmingham meeting of the British Association for the Advancement of Science. The Piltdown skull, the latest find of fossil man, was one of the chief centers of discussion, dividing popular attention with Sir Oliver Lodge's speculations on the future life, and the trade problems of the Panama Canal. Other announcements and discussions, some of them of no small scientific importance, attracted little or no notice outside of small groups of specialists. Some of these contributions had an important bearing upon problems of more popular interest. But the relationship was indirect and passed unobserved, its influence to be seen and recognized only at a later date.

In view of their absorbing interest it is peculiarly unfortunate that fossil remains of man and of his prehuman ancestors are so extremely scarce. Nature, in preserving her records of the evolution of life, has shown no preference for her present favorite. While the records of man's ancestry are not quite the rarest of fossils, yet they are exceedingly rare in comparison with the fossil remains which illustrate the evolution of many well-known races among the lower animals. The record is imperfect, and it quite fails to furnish that overwhelming mass of direct evidence which would refute and silence all opposing criticism. The evidence for the evolution of man, for his descent from a common ancestry with the lower animals, convincing as it is to every well-informed and unprejudiced scientist, is yet chiefly indirect evidence, and the lack of direct evidence has always been a stumbling block to the evolutionist in his attempts to convince the world at large of the truth of his theories. It is quite true that with many—indeed with the greater number—of the races of lower animals now in existence, the direct record of their past history and evolution is as imperfect and inconclusive

as that of man, or more so, and yet this does not deter the opponents of evolution from accepting the theory in regard to all other animals while denying it with respect to man. But in these cases the evidence is considered impartially. If the critic accepts the theory of evolution of the horse and the dog, as proved by both direct and indirect evidence, he has no especial difficulty in accepting it for the angleworm upon the indirect evidence of structure and physiology alone. But he draws the line at man, and declares that while the mind and body of a dog may have been evolved from a bit of protozoan jelly by the slow and gradual processes of natural evolution, the mind and body of a man cannot have been so evolved.

With the logic of such a position or the often ingenious arguments by which it is defended, I am not here concerned. Plainly stated, this is the view taken, not indeed by scientists, but by a large section of the nonscientific world. The lower animals may have been evolved through the processes of natural law, but man is a special creation, his fundamental and detailed resemblances to other animals being obscured in their minds by the disproportionate development of his mentality, looming large in the close perspective in which it is viewed, and the differences further accentuated by a new set of terms applied to various phases of this exaggerated and highly specialized mentality, phases of which the germs may be obscurely seen in the higher quadrupeds, but which appear definite and distinct in man.

Obviously the only evidence that will convince the opponents of evolution will be the discovery of a complete chain of ancestral stages connecting man with the primitive tree-dwelling ancestors from which the indirect evidence indicates his descent and of which the living apes, monkeys, and lemurs are more or less altered survivors, in varying degree less progressive. But only a few fragments, broken links of such a chain, have as yet been found, and their pertinence to man's ancestry rather than to some other related chain of descent is in every instance open to more or less question. There is nothing exceptional about this, unfortunate as it is. There are many races of animals of whose evolution there is little or no record among fossils. Several reasons account for this imperfect record.

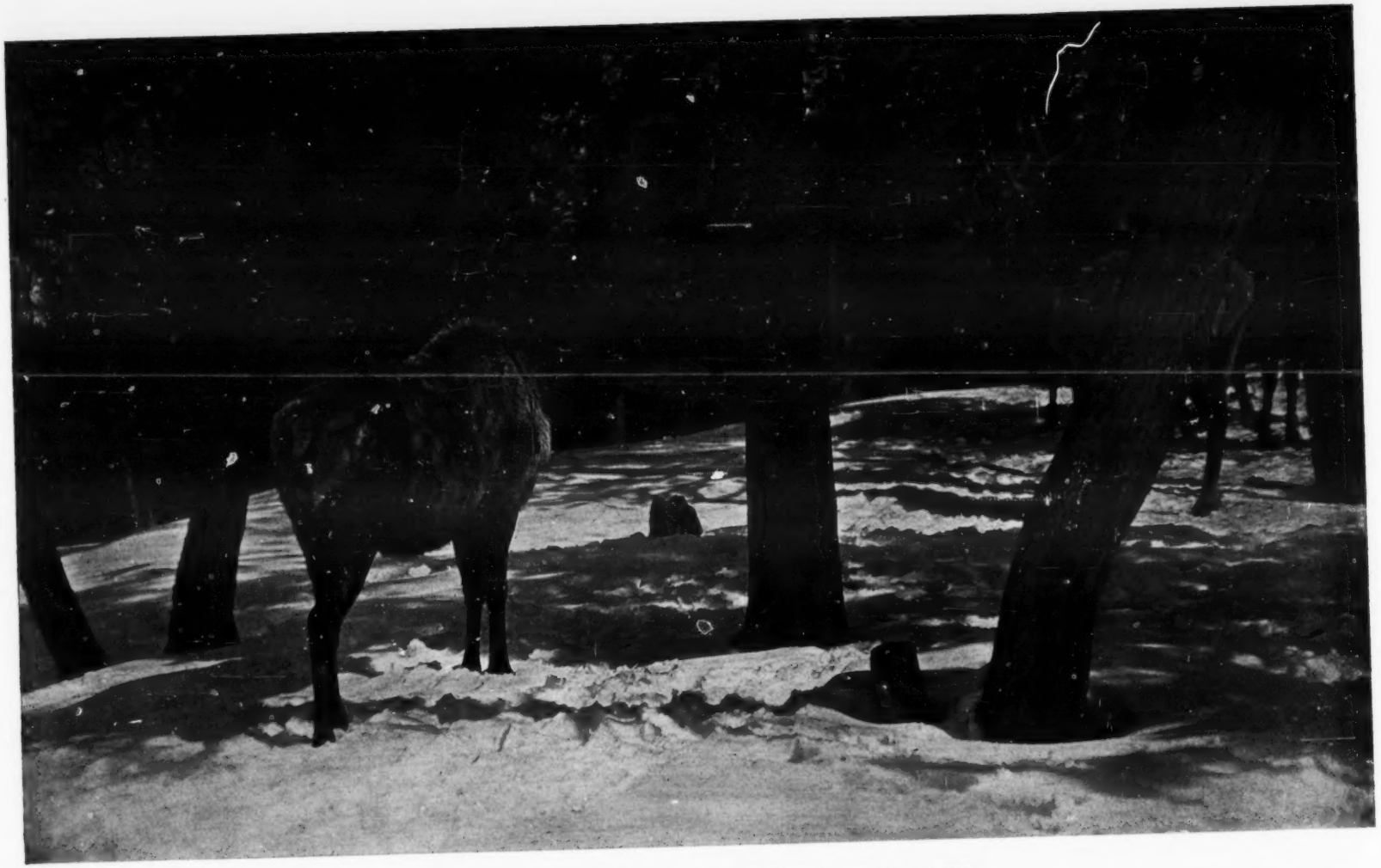
(1) There may be no hard parts in the body, so that nothing can be petrified and preserved, save under most unusual circumstances.

(2) The hard parts may be small and delicate, and the habits and dwelling place of the animal such that its remains would rarely escape destruction before they could be buried and preserved by petrifaction.

(3) The animal may have lived only in some of the unexplored or inaccessible regions of the world, or in areas where no geological formations were being laid down at the time, or where such formations have not been preserved to the present day.

While the first reason does not apply to man's ancestors, the others pretty certainly do; and so far as one may judge, they account quite satisfactorily for the scarcity of the remains.

There are several lines of evidence—historical, archæologic, ethnographic, etc.—that concur in indicating the continent of Asia as the probable cradle of the human race and more probably north than south of the Himalayas. Here we believe that man evolved from small tree-dwelling monkey-like ancestors, and from this central region he spread to east and west and south, finally overrunning all the outlying continents and the islands of the ocean. Here, then, somewhere in the great desert regions of Central Asia, we may hope to find the earliest human remains and the fossil bones of man's ancestors, in the Tertiary formations which may be discovered and explored by the scientists of coming generations. As yet the geological exploration of the world is but in its beginnings. The preliminary reconnoissance and mapping of its strata are well advanced in Europe and North America, elsewhere they have only commenced. And the more thorough search by which the fossils characteristic of each formation are secured for study and adequate evidence obtained of the successive faunas and floras which inhabited the region, has covered only a part of Western Europe, a minor part of the United States, and a few scattered areas elsewhere.



THEY ARE THREATENED BY STARVATION EACH WINTER

With the first snows of autumn the elk start slowly on their annual migration to the lower, sheltered valleys where the grass is not too deeply buried and the winter winds are broken. Only great bulls in their prime, able to paw through deep snow, remain scattered within the middle valleys of the park, or even on the mountain tops where the wind clears pasturage for them. The chief danger which threatens the herds is progressive occupation of their winter ranges by cattlemen and hunters. In former years the elk passed downward to the plains, but now these are all occupied, and the elk by being restricted are threatened with starvation. If they wander beyond the protection of the Government, expectant hunters await them—as was illustrated last winter when unusually heavy snows drove thousands to their destruction in Montana

Story of the Whitebar Elk[1]

By M. P. SKINNER

Park Naturalist, Yellowstone National Park

IN the northern part of Yellowstone Park there is a quiet and lovely valley; through it flows Slough Creek. The valley bottom is a long meadow divided midway by a short and rocky cañon; it is from one to three miles wide and bordered on either side by high and rocky ranges that still show the effects of the resistless forces of the Glacial epoch. These ranges are covered on their higher slopes by a dense growth of pine, while the lower are unusually beautiful with their numerous open, grassy parks, alternating with groves of quaking asp, of fir, and of pine. The upper meadow is, for the most part, covered by grass, with low willow thickets along the stream; the lower meadow is still more striking with its smooth, green level, broken by clumps of quaking asp, with here and there a few dark firs. This valley is a favorite winter feeding ground for immense herds of elk with an occasional mule deer, or a buffalo. In the spring its meadows and ponds are frequented by vast numbers of Canada geese, and by many species of ducks and other water birds; and in the late summer and early fall Slough Creek is a famous fishing ground for the black-spotted trout.

To us, it is especially interesting as the winter and spring home of the elk. It was here in early June when the bright green grass and the fresh, rather yellowish, foliage of the quaking asp formed a delightful contrast with the darker fir groves, that "Whitebar" was born. I may call him that now but our little elk was not known then by the name, for it was much later in his life that the sportsman's bullet seared its way across his shoulder. He was only one of many elk born that year in Slough Creek Valley, but none among the many was destined to become as mighty a bull as he and as great a king among his kind. He was dark brown in color with numerous spots of lighter brown; his legs were too long for him, and only just strong enough to support him for a few minutes at a time.

His mother hid him carefully in the weeds and brush whenever she left him to find grazing for herself, and by some strange instinct he always remained so hidden until she returned. It was while he was thus concealed that he had his first adventure, for one day one of the soldiers that formerly guarded the park came down the banks of Slough Creek and found him. The care of vast numbers of animals has its effect upon the men who guard them. They lose much of their desire to hunt and kill. This soldier had no evil intentions toward the big-eyed, helpless little animal lying so motionless; but he did wish to test what he had so often been told—that a man is able to catch a very young elk when it is hiding. He did actually pick up the baby and place it upon its feet. In doing so, however, he broke the spell that had caused the little elk to lie so still, and it ran as fast as its tottering legs would permit—luckily in the direction of the returning mother.

After a week or ten days of this hide-and-seek life, the little elk's legs became more serviceable and his mother led him by slow and easy marches (gradually increasing in length each day) out of Slough Creek bottom and up on the heights of Specimen Ridge to the south. Specimen Ridge is a fine open grazing ground, high enough to escape the heat and the flies of the lower valleys; but for our elk and his mother it held one grave and unforeseen danger. Coyotes are not very formidable enemies of the young elk when their mothers are with them. But when our elk was a month old, a large coyote, fierce and hungry because of a long term of unsuccessful hunting, made a desperate attempt to get Whitebar. It was early in the morning when the fight began. The mother elk could fight only by attempting to strike with her forefeet or to knock the enemy over with her head. The coyote was too swift for her to run down or chase away; and besides she was hampered by the little elk, which kept close to her side or at her

[1] Illustrations from photographs by the Author.

THE ELK OF THE YELLOWSTONE

The herds of the Yellowstone National Park region are the only remaining great stand of elk in the United States. The mountain ranges at the headwaters of the Yellowstone and Snake rivers have long been a summer feeding ground for these great game animals where as many as 25,000 come with the melting of the snow to graze on the fresh grass of the alpine meadows. No inducement other than protection is necessary to keep the elk within the park, for they unerringly find and occupy areas closed to hunting

heels. On the other hand, the coyote had to be very wary and very cautious; one successful blow from the elk's lightning-swift hoofs would mean his death.

The struggle went on all that long, hot day: the coyote continually worried his prey but was forced to keep out of range of those terrible hoofs; the elk continually tried to get in one deciding blow. More and more tired became the mother until it seemed as if she would lose her life in defense of Whitebar (for she could have run away at the beginning had she cared to do so). No help seemed near for her; and that menacing gray form was always just before her and always just out of reach. But help was near. Late that afternoon a government ranger came riding by. The coyote saw him in the distance, and well he knew what rangers are; well he knew that they carry death-dealing rifles; and well he knew that there is no sanctuary within the park for such as he. The coyote was forced to run, and our little elk and his mother were saved; but it was many a day before they recovered their strength, and perhaps they never would have recovered it if the rich grass had not been thick and easy to get on Specimen Ridge.

For the rest of that summer our elk remained upon the upland grazing grounds with many other elk and their calves, always busily feeding and gradually taking on fat to help them over the coming winter. On the approach of fall the young elk gradually lost the spotted coat of his babyhood and his hair grew longer, thicker, and was lighter in color. As cold weather drew near, the mother took him down toward the valleys, forded the Yellowstone River, and passed near Tower Falls. Slowly, very slowly, going only a mile or two a day and often retracing their steps, they made their way past the Petrified Trees and Yancey's, and on to the country of the Blacktail Range. By the time the first severe snow came they were safe in a well-protected valley where the snow did not fall as deep as upon the higher altitudes they had left.

Now the winters in Yellowstone Park are likely to be long and a very severe test upon the strength of all the animals. Food is scarce and hard to get, and the long, bitterly cold nights often kill the half-starved and weakened animals. That this first winter of our young elk's life happened to be a mild one was of vast importance to his growth. He was already a well-grown little elk owing to his mother's good care and the nourishing grass they had had all summer. The only setback had been the coyote fight, and he had not taken the brunt of that. During this mild winter the mother elk was able to secure a fair supply of food in places where the wind had blown off the snow. Often she pawed the snow with her forefeet; and often, when the snow was freshly fallen and light, the elk were able to push it aside with their noses while they fed on the grass exposed. As spring drew near, the sun became warmer and warmer, and by the end of February it had melted the snow a little, revealing many patches of grass which had been hidden during the winter. Later, fresh grass appeared here and there, and the starving time was over.

One day Whitebar wandered a short distance from his mother, and when he came back, she was gone. Of course, he did not know that it was usual in elk land for calves to lose their mothers about this time of year. He was a self-reliant young animal, however, and although he looked for his mother for a week or more and occasionally called for her, he never saw her again. Still he managed to get on, for she had done her work well and he had become wise in the ways that young elk should know.

The weather grew warmer and he climbed higher and higher. He did not return to the Specimen Ridge of the previous summer, but instead he made his way in a southwesterly direction. One morning as he was resting under some pines, he was startled by strange noises. By this time, our elk knew all the more common sounds of the forests and meadows, but this was like none of them, being far louder than any he had ever heard. As he hesitated whether to run or to find out what the noises meant, he saw a stage-load of talking, laughing people going by through a little meadow not far off. After that morning, he saw many more tourist stages; their approach was always heralded by the strange noises, and they always went hurriedly by. But they did not hurt him, in fact I doubt if any saw the elk

peering out at them from behind some convenient thicket of small pines. They were a source of much curiosity to Whitebar; and as he got used to them, the happy joyous people seemed to fit in with the birds and animals about him and he was not afraid.

After a short time the weather became still warmer and the flies more annoying, and the elk was forced to move on again. In seeking the higher mountains, he entered a strange valley, where the ground was quite white and had neither grass nor trees upon it. From many parts of it columns of steam rose high in air, and often jets of water spurted into the air only to fall back again. There were many strange sounds of roaring, hissing steam and water falling and dashing upon the rocks. The air was filled with hot, acrid, stifling odors; and again there were tourists, but there were no stages and the people were walking to and fro over the white ground among the rising jets of steam and water. In fact, our elk had happened upon the Norris Geyser Basin. He crossed it after the sight-seers were gone and continued on up the hills before him.

In time, he reached the top of the Madison Plateau; and finding among the cool pine forests abundant food and freedom from the little stinging flies, he spent the rest of the summer there. Now all through that summer the first pair of horns had been growing. They had only two points on each antler, but they were the forerunners of many mighty antlers to come, for elk shed their horns every spring and grow another pair during the summer. These first horns were small and the covering of skin or "velvet," as it is called, remained upon them—as it often does on an elk's first set of horns.

At the approach of his second winter our elk turned northwest and descended into the Madison Valley, instead of returning to the northern section of the park. This was another fortunate move that no doubt had its effect upon his strength and growth, because the second winter of an elk's life is the critical period that determines whether he will be large and strong, or remain commonplace. The grasses of the Madison were particularly luxuriant, and there were fewer elk there so each had a larger share. This winter was an average one but he was able to get abundant food all through it, and when spring came he already showed many signs of the great strength and beauty that were soon to be his.

Whitebar spent his third summer, and had his last experience as a member of a herd, in the upper Hayden Valley with the cow elk, small bulls, and calves that usually summer there. This year he grew a pair of horns that had four points on each antler; and unlike his first pair they lost their velvet in the fall and were sharp and serviceable.

But that third winter is one long to be remembered in those mountains. The snows came early and fell fast and heavy. From October to June the storms were almost incessant; snow followed upon snow with but little interval. Among the animals it was the great starvation year. As the snows grew deeper and deeper, the elk found it more and more difficult to get enough grass to sustain life. Then spring approached, and still there was no decrease in the fierce snow squalls that swept the region, no break in those bleak, wintry days, and the elk began to die by scores. By the time the warm June sun appeared, the terrain was covered with hundreds of dead and dying animals. How was it with Whitebar? Again we see one of those lucky happenings which contributed to make our elk the magnificent animal he was. Early in the winter he had found a partly spoiled stack of hay left by the men who had gathered hay for the Buffalo Farm. When forage became scarce he returned to it and never during those bitter days did he wander far from it. It was his salvation, for he came through that trying time very much better than did the other elk.

He passed his fourth summer in great contentment and grew his third pair of horns, a full-sized pair with five points each. Elk horns may grow much larger, with six, seven, and even eight points, and a few curiously deformed horns have many more. Nevertheless five points per antler is the full-grown size. Our hero, then, had now come into his full elkhood. He felt it in his strength and power, and showed it when he began instinctively in late August to "horn the brush" in his en-

deavor to rid his horns of the still clinging velvet. Early in September he gave another sign of his maturity in attempting to whistle, or "bugle." Other deer, notably the moose, give similar challenges; but neither do the notes become so clear and ringing in any other mammal, nor does any other issue these challenges so frequently. Nor have I ever heard any other deer challenge just for the fun of it, as elk seem frequently to do. Each autumn the elk whistles are to be heard all day long on a good range and often all through the night, although the early morning is apparently the favorite time. With elk the bugle seems to be an incident of the mating season. It is at times a call, a challenge, or occasionally just an expression of the life and power that the elk feel coursing through their veins. The rutting season lasts from early September to late October. To one unaccustomed to elk on their native range it is a great experience to be among them while the bulls are bugling and often fighting, and the mountains that have been so silent and forbidding all summer suddenly seem full of life.

Early during his next winter, our friend gave another sign that he was now a full-grown elk. Instead of descending to the low valleys, he elected to spend the winter upon the Blacktail Range of mountains. Bull elk in the prime of life often spend their winters high upon the open ridges from which the winter winds sweep away the snow. The brave, hardy animals are even better sustained than the elk of the low levels, for the grass is nourishing and easily obtained; but woe to the weakling that braves the winters in such exposed places. Our elk did well on the wind-swept ridges of the Blacktail Range.

In April Whitebar shed his horns again, and only the bony butts were left. As soon as the horns dropped, the skin grew up over the tops of these butts, which in turn began to swell. Thus within a week after the falling of the old horns, a pair of skin-covered knobs took their places. They were about the size of a large tomato, rather darker in color, and full of hot, swiftly flowing blood. They kept right on swelling, but it was noticeable that soon they began to acquire shape. Rapidly they grew, forming branches and points at their proper places, each branch and point ending in a knob until it was completed. During this growth the horns remained covered by the skin (or they were "in the velvet") and filled with numerous blood vessels carrying the rich material necessary for the rapid growth. The horns were extremely sensitive to the touch while in the velvet and the elk carefully avoided hitting them against anything. By the end of July the antlers had stopped growing; the knobs had been gradually absorbed; the velvet had dried and withered; and the horn structure itself had hardened, losing the blood vessels which had furnished the growth and the nerves which had prevented injury to the horns by making them sensitive.

While his horns were growing he had other experiences. He had worked along the mountain range to its southern end and crossed over to Mt. Washburn. Here he encountered men again, but these were far different from the tourists he had watched so long before. They were more silent and did not travel in stages. They were engineers engaged in the work of building a road to the top of Mt. Washburn. They did not bother the elk and soon he became used to them. So little did he fear them that later when they blasted out the rock, he remained feeding indifferently within a few hundred feet. Had he only known it, he was witnessing a wonderful sight; at noon when the men went to lunch, long lines of blasts were set off. The whole crest of the mountain would seem to rock and shake with those tremendous salvos resembling the discharge of powerful guns along a lofty rampart.

This familiarity with men was like to have cost our elk dear. That year in following elk custom during the rut he wandered far and near and soon he was outside the east boundary of the park. It happened that a sportsman was there too; but the elk was not frightened until the report of a gun sounded and our elk felt a hot, stinging blow along his side. He ran, and fortunately ran into the park so that the hunter could not follow. By instinct he began to climb the mountains and soon he lay down on a snow bank and his fevered side was cooled; that night it rained, and the water washed out the wound and helped to cool the mounting

fever. Luckily that autumn was an open one and the heavy snows were late in arriving. Our elk remained near the mountain tops, feeding when he could and often lying down on the snow banks. Slowly he recovered and was able to get down to the winter range near Soda Butte. It was well along in the winter before he fully recovered and he was left with a white bar across his left shoulder that won for him his name.

That winter Whitebar moved to and fro throughout the northern part of the park. In March he found himself in what is known as the Hellroaring country, from a creek of that name. This was a fine winter grazing ground but infested with mountain lions. A mountain lion usually hunts by lying in wait in some tree or on some high rock above the trail, pouncing down upon the prey as it passes underneath. Mountain lions do not as a rule attack full-grown elk, and, moreover, Whitebar was especially wary and fleet. Thus he passed safely through the winter in the big cat's country.

The sixth summer was spent amid the many beautiful open parks on Mirror Plateau. Often he met others of his kind, but the summer was a time of peace in elk land and these meetings were uneventful. Often, too, he met coyotes and even bears, but none cared to attack an elk of Whitebar's size, especially as other food was plentiful and easier to get.

It so happened that this season was a dry one and the grass for winter forage did not grow well. Whitebar wandered back again to the Slough Creek, and for a time did well on the scattered feed; but long before spring the forage gave out. Our elk, however, was now big and strong and with the help of bark from the quaking asp he was able to get through. But the year was a hard one on the other elk and before fresh grass appeared all the aspen trees were barked from the ground up for five feet, and even higher where the snowdrifts afforded a platform on which to stand. Often the elk were able to push over the weaker trees and then not only was the bark completely stripped off, but all the twigs and smaller branches were eaten also.

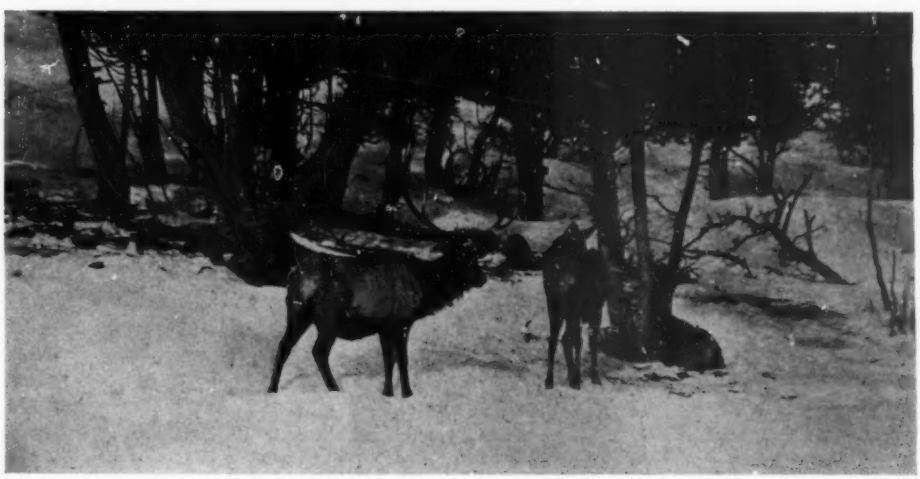
Whitebar was now a great bull elk, mighty in size and strength. Many experiences and escapes had made him wise, and he was quick to scent danger and quicker still to get away. Among his own kind he was a king, ruling absolutely the little herd of cows that he acquired each year. Rivals he fought at sight and usually conquered. If the defeated elk had had a following of cows, Whitebar took them as his spoils of battle. Thus by the time autumn was over he was the center of quite a herd—only to lose them during the winter when the fight for existence drove every elk, cow and bull alike, to look out for itself.

Well do I remember a fight I witnessed between Whitebar and another bull of about the same size. It took place in an open vale almost surrounded by dark pines and firs at the edge of the flats of the upper Yellowstone River. On the east was a towering range of mountains over which the sun was just appearing. The morning was still and frosty, and a foot or so of light, fluffy snow covered the ground, although it was only October. I had been conscious for some time as I came down the trail that a bull elk was bugling ahead of me. Just as I neared the edge of the timber, an answering challenge came. I hurried carefully forward, for a meeting between two big bulls such as the hoarse notes revealed them to be would be an event. Soon I caught sight of Whitebar. There was no mistaking him. The peculiar mark across his shoulder was gleaming white in the sunlight. Very many times before had I seen this elk, and many hours had I spent in admiring his strength, his beautiful form, and his majestic appearance. During the years I had known him Whitebar had grown larger and larger until he was known far and near as "the big bull." Each year his horns had grown larger and had excited much admiration among the men who knew him. Many were the schemes of hunters to get him, but Whitebar was too wary. I doubt if he had any idea where the park boundaries were, or even if there were such things, but he did know where he was safe. He did not know that as long as he remained within the park the long arm of the government protected him from the one enemy with whom he could not cope, but he did know that in certain places men never bothered him. He no longer feared any enemy; in fact he had no enemy, except

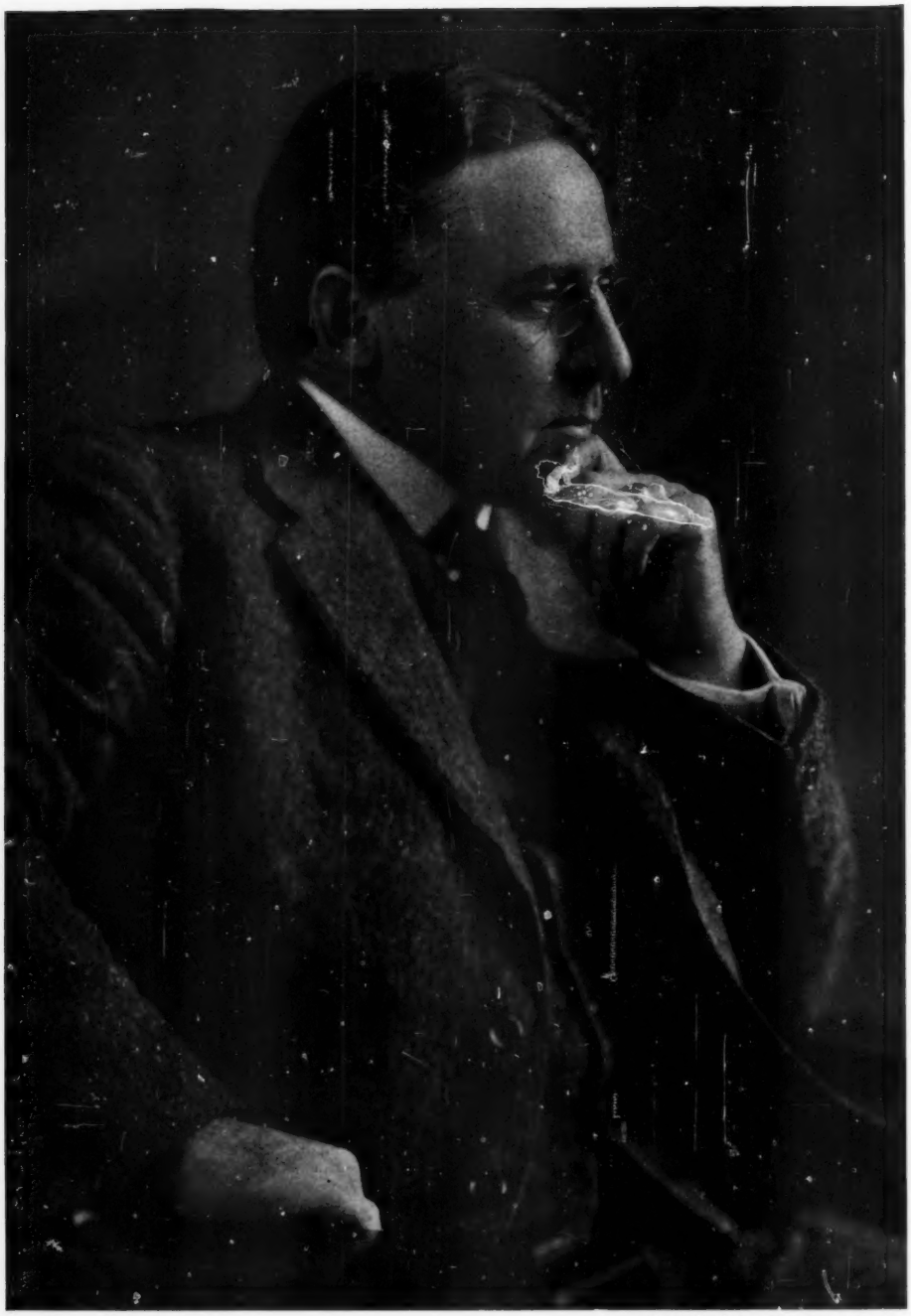
man, as none cared to pit himself against the prowess of the monarch of the Yellowstone. He was monarch of the mountain parks and meadows just as truly as his big relative, the moose, was monarch of the marshes, and as the grizzly was monarch of the forests.

When I came in sight of him that morning, Whitebar was horning a pair of four-inch saplings; and he did it with a vigor that tossed the saplings this way and that and all but uprooted them. Later I tried to shake those saplings myself and could just barely move them by a fraction of an inch! Occasionally he stopped to bugle and always came the answering call, nearer and nearer. Soon the on-coming bull walked into sight, and he was almost an exact duplicate of Whitebar in size. At the same time Whitebar left his saplings and came to meet his adversary. Slowly they approached each other, slowly lowered their heads, and gently placed their horns together. But at the touch, the power lurking in strong muscles awoke; harder and harder came the strain. The fight lasted only a few minutes. Each combatant strove to push the other back, occasionally the horns would separate only to come together again with a sharp crack. Only in the "cracks," in the straining muscles, in the fierce bloodshot eyes, and the panting snorts could one see the tremendous power being expended. At times one of the elk would give a savage side twist of his horns to reach an unguarded flank. But always the opponent was able and spry enough to spring around and escape. And then the straining pushes and panting snorts would begin again as the two powerful heads came together once more.

Slowly the stranger elk was pushed back step by step only to recover and force Whitebar in his turn to give way. There was little to choose between the two combatants; they seemed equally powerful and equally determined to win. Round and round they went, first one would gain a little and then the other, but neither could master. Suddenly the stranger went down on his knees. Was he overcome by strength, or had a piece of ice proved a treacherous foothold? Or had the snow concealed a soft spot of ground? Be that as it may, the fight was over. The conquered elk slowly retired with many an angry shake of his antlers, and Whitebar was left the victor of this, his greatest battle.



For protection of the Yellowstone elk during the winter the Biological Survey and the Forest Service propose an extension of Yellowstone Park southward, the setting aside of state game refuges, and the establishment of government ranches where hay may be raised for emergency feeding in severe seasons. Hunting licenses in surrounding states must also be limited and legitimate hunting regulated so that only the annual increase is taken. The present herds will not be enlarged, except at certain points, for the available ranges will not support greater numbers of grazing animals



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T. GILBERT PEARSON

President, National Association of Audubon Societies, Elected October 26, 1920

Mr. Pearson has been affiliated with the National Association of Audubon Societies since January, 1905, when he was engaged to assist Mr. Dutcher and was elected secretary of the newly incorporated association. From the time in 1910 that Mr. Dutcher became incapacitated for work until now the administrative affairs of the association have been carried on by Mr. Pearson. As a tribute of respect, Mr. Dutcher was retained as president until his death, July 1, 1920, and at the meeting in October Mr. Pearson was elected his successor

A Year's Progress in Bird Protection[1]

By T. GILBERT PEARSON

President of the National Association of Audubon Societies

ONE of the most significant occurrences in the field of bird protection the past year was the decision of the United States Supreme Court upholding the constitutionality of the Migratory Bird Treaty Act. This was the final scene in the drama which began in 1904 when Representative George Shiras, 3d, introduced in Congress the first bill intended to place under federal protection the fortunes of North America's migratory birds. All Audubon Society members will be interested in the final outcome of this long-waged battle in which the National Association and its affiliated organizations have taken such a prominent part. It was at our suggestion and through our insistence that the original bill was modified to include the protection of migratory nongame birds.

The past year has seen further efforts to open conventions with the republics to the south of us with a view to securing protection for our birds that migrate to South America. The urgency for such a course does not yet lie clearly before us, but the matter is under advisement and the United States Government has sent a naturalist to South America to investigate the benefits to be derived.

Of late, vicious attacks on the national parks have been made in Congress by those who would grant favors to western land interests at the expense of the country's richest nature sanctuaries. A bill to allow certain exploitations of the Yellowstone National Park came very near of passage, and another, intended to place the authority for granting water power rights in the national parks in the hands of three members of the President's Cabinet, actually passed both Houses of Congress, and President Wilson, in spite of an avalanche of letters and telegrams, signed this measure and it became a law. This statute should most certainly be repealed at the coming session of Congress. Much effort undoubtedly will be required to defeat other Congressional measures for exploitation of national parks. Attempts to secure such adverse legislation now seem most certain.

In January, 1919, through the columns of *Bird-Lore* this association first advised the public of the Eagle Bounty Law in operation in Alaska. Since then we have continued to bulletin, from time to time, the results of this measure. The last report from our representative in Alaska showed that the official territorial records reveal the fact that bounties had already been paid on the feet of 8356 eagles. Nor does this tell the entire story of the appalling slaughter of the American eagle, for it should be borne in mind that to collect the fifty cents bounty it is necessary to bring in the feet to some territorial official and pay a fee for an affidavit to accompany them before the bounty can be collected. Men who secure only one or two eagles at a time, or who shoot their birds a very long distance from the place where the bounty is paid, of course never report their killings. Furthermore, many hundreds of eagles undoubtedly are wounded by gunfire and escape in the wilderness to die later from their injuries. We have filed the most vigorous protests against this law and for a time it appeared there were prospects of getting it repealed by the territorial legislature, but the latest reports are that a great majority of the people of the region, including Governor Riggs, have such fixed ideas of the destructiveness of this bird to fish and game that the Bounty Law is in no immediate danger.

By the death of the president of the association, William Dutcher, on July 1, 1920, there passed away the leading pioneer in the cause of American bird protection. He was responsible for the establishment of this association, and from the time of its incorporation in January, 1905, until he was stricken with paralysis in October, 1910, its growth and welfare were matters of ever-abiding concern in his mind. Although helpless for ten years, and deprived utterly of the power of speech or the ability to write,

[1] Extract from the report presented at the annual meeting of the National Association of Audubon Societies, held in the American Museum of Natural History, October 26, 1920.

he never lost interest in reading or hearing of what was being accomplished for the cause that lay so near his heart. The memory of his name and his work will never fade as long as men take note of the feathered guardians of the field, or lift their heads to listen to the wild, sweet music in the trees.

This association's system of employing special guards to protect important breeding places of water birds cannot for one moment be relaxed. This is one expense that has to be met every summer, no matter how limited the funds may be or how strong the calls come for expenditures in other directions. Sad experience has shown that, especially in the case of the nesting egrets, a colony left unguarded means a colony in which the birds are sure to be shot.

During the past year we employed thirty-seven wardens, distributed as follows: New York, 1; Massachusetts, 1; Virginia, 1; Georgia, 1; North Carolina, 1; Mississippi, 1; South Carolina, 2; Michigan, 2; Louisiana, 3; Florida, 11; and Maine, 13. The nesting season in the guarded colonies was a fairly good one for 1920. The loss of life from high tides and storms was not greater than for an average normal year, and no raids of consequence were carried out by feather hunters.

During the spring the United States Biological Survey detailed special agents to operate in Florida in order to break up, as far as possible, the illegal traffic in aigrettes. The secretary of the association had supplied the chief of the Biological Survey with a long list of names of people who, it had been reported, were engaged either in killing birds or shipping plumes in that state; and to assist in carrying on this work the association appropriated $1600 for the Survey's use. A large amount of patrolling was done by these wardens in southern Florida with much attending publicity. Also some violators of the law were apprehended and fined, notably a man named Mackinson, of Kissimmee.

We have no Audubon wardens located in New York City, although we could use one or more to most excellent advantage. Members of the Association and others often report by letter or telephone violations of the bird and game laws. These reports we at once place in the hands of the state game warden department for the state from which the complaints were received, and many prosecutions have resulted.

The "field agents" employed in recent years have been continued: E. H. Forbush, for New England; William L. Finley, for the Pacific Coast; Winthrop Packard, for Massachusetts; Mary S. Sage, for Long Island, New York; Arthur H. Norton, for Maine; Frances A. Hurd, for Connecticut; and Herbert K. Job, in charge of the Department of Applied Ornithology. Through lectures, published articles, correspondence, and personal work, this body of men and women are annually performing services of great value to the cause of wild-life protection.

All previous records in the organization of Junior Audubon classes were broken the past year. Before the spring had far advanced, the 200,000 sets of literature, bird pictures, and Audubon buttons prepared for the entire year's work became exhausted. Eighty thousand sets of leaflets and pictures left over from previous years were brought out of storage and were readily accepted by pupils and teachers in lieu of this year's material. By the middle of May all possible sources of supplies had been exhausted and regretfully we began returning to the disappointed children their ten-cent fees. Our ever-generous and unknown benefactor again gave $20,000 to this cause for the past year. With a total of $27,500 we enrolled and provided supplies to 280,963 children in the United States and Canada. I regret to state that collections for the coming school year have not thus far been as good as last, and the prospects are now that little more than two-thirds as many children can be supplied this year as last. To those who may see this report and who, seeing, care for children and the birds, let me remind them that for every gift of $100 for this work about 1000 children will be able to join the Audubon Society, wear its button, study its lessons, and learn many worth while facts concerning the wild bird life about them.

The Question of Correct Diet

TEACHING FOOD HYGIENE TO SCHOOL CHILDREN BY MUSEUM METHODS

By MARY GREIG

Assistant, Department of Public Health, American Museum of Natural History

THERE is abundant evidence to show that proper food promotes health. Plants under experimental conditions can be made sickly by the wrong food or healthy by the right food, and the same is true of animals, and of course of children. In all these cases the sickly individuals might just as well have been strong and healthy. There is nothing essentially difficult about the subject of nutrition. We could just as easily learn good habits of eating in youth as the bad ones we learn now, and the American Museum is planning to do all it can to help the children of New York City along this profitable road to learning.

The attention given to the food problem during the last five years has resulted in a real and permanent gain in so far as it has turned our minds from eating for the mere purpose of pleasing the palate to a consideration of the scientific use of foods for the satisfaction of the physiological needs of the body.

The shortage of food in Europe during the war forced statesmen to realize that the food supply is one of the chief problems of national existence. England, a manufacturing nation, imports two thirds of the food she eats. The German submarines reduced by one half the number of ships that could be used to transport this food. Despite this handicap, the use of a scientific rationing system for all staple foods brought about a condition whereby "there was probably an actual increase in the average consumption of food in the United Kingdom in spite of the world shortage of food,"[1] from 1916–18. A nation with such an accomplishment to its credit will hardly be likely to go back to the ignorant and haphazard methods of pre-war times, when, as is shown by the figures of Rowntree, 30 per cent of the population was improperly nourished.

Possible Food Resources of the World Far in Excess of Any Present Demand

The world shortage of foodstuffs is due largely to mismanagement and lack of organization, and not to any inability of the earth to support its inhabitants. There are acres of exceedingly fertile marsh land which can be drained, and deserts which can be irrigated. The food resources of the sea and of the tropics are barely touched; and development of many areas now unproductive is made possible by our victories over the mosquito and other disease-causing insects. Russia could perhaps easily double her population if she utilized her unused grain lands, and even the Chinese and Japanese have by no means caught up with their resources. "With every article of food except meat we can easily and greatly increase the supply in the western world."[2]

Science has only begun to show us a few of its limitless possibilities. By its means we have increased the sugar content of the sugar beet sevenfold through selective breeding. We have discovered how to prepare a synthetic dye, thus releasing for food the acres previously planted to supply indigo. We have scarcely begun to attack the problem of "waste" in the transportation of food. The saving that can be accomplished here is a potential resource of enormous magnitude. "Half of the fruits and vegetables produced in the United States never get to market."[2]

America a Food-exporting Nation Yet Malnutrition One of the Country's Real Problems

In the last fifty years the population of this country has increased from 38 million

[1] *The Oliver Sharpey Lectures on The Feeding of Nations.* By E. H. Starling. Longmans, Green and Co., London and New York, 1919.

[2] *The World's Food Resources.* By J. Russell Smith. Henry Holt and Company, 1919.

to 104 million, and although, because of our great resources, we are still a food-exporting nation, we face a real problem of malnutrition throughout all parts of our country. Conservative government statistics place the number of undernourished children in the United States at about three million. This condition is by no means confined to the children of the poor, but is also prevalent where there is ample money to buy proper food. Such widespread malnutrition is due mainly to ignorance of food values, but it is more serious to be ignorant nowadays than ten years ago because high prices have reduced the variety of foods from which our selection may be made.

How Shall We Inculcate Correct Dietary Habits?

It has always been realized that the quickest and most lasting reforms can be brought about by concentrating our efforts upon the children. This is particularly true in matters of diet because any dietary reform involves changing our habits. We may convince a grown man that he should reduce the quantity of meat in his diet and eat more vegetables but if he is used to meat two or three times a day and the flavor of vegetables seems too bland to his pampered taste, the likelihood of bringing about a permanent change is often slight. It is not until some serious disease threatens his usefulness in middle age that many a man consents to eat for the sake of the welfare of his body as a whole. The unperverted appetite of a properly trained child of four years, which leads him to take with evident relish a piece of bread, a dish of carrots, or a glass of milk, is an object lesson to us. The purpose of dietary education is to transform this rational appetite for simple foods

				Vitamines		
	Energy	*Protein*	*Mineral Salts*	*Fat Soluble*	*Water Soluble*	*Anti-Scurvy*
Grain products and dried beans and peas	Cheapest source	Cheap source but deficient in certain necessary kinds of protein	Good source of certain salts but low in calcium	Variable	Present except in highly milled grains	Lacking
Meats	Costly source but depends largely on cut	Contain proteins of good quality	Source of iron but lacking in calcium	Not abundant	Present	Very low content
Root vegetables	Fairly cheap source	Contain certain proteins but inadequate as sole source	Good source	Variable	Present; better source than meats	Present; usually abundant
Sugars	Very cheap source	Lack protcins	Lack salts	None	None	None
Fruits	Fresh fruits expensive source; dried fruits fairly cheap source	Poor source	Fresh fruits costly source; dried fruits cheap source	Unknown	Present	Abundant especially in orange, lemon, and tomato
Nuts	Cheap source	Fairly cheap proteins but inadequate as sole source	Good source	Unknown	Unknown	Lacking
Milk	Fairly cheap source	Good quality proteins	Best source	Abundant (Milk is the best source of this vitamine)	Present	Present
Leaf vegetables	Very little energy value	Fairly good source	Valuable source especially for calcium and iron	Abundant	Present	Present; usually abundant
Butter	Cheap source	Lacks proteins	Poor source	Abundant	Lacking	Lacking
Eggs	Expensive source	Expensive source but contain proteins of excellent quality	Rich in mineral salts. Lower than milk in calcium	Abundant	Present	Unknown

Special values of various foods.—This table has been prepared to accompany the traveling exhibit sent out by the American Museum, and to show clearly and concisely in chart form the rôle played by each type of food in the diet,—which food constituents it supplies and which it lacks

The problem of malnutrition among school children is being attacked by the New York City Department of Education, in coöperation with the American Museum, by means of a traveling exhibit illustrating the correct principles of diet. The exhibit includes eight wall charts, a set of colored blocks setting forth the composition of six common foods, and, of primary importance and interest, a set of sixteen wax models of foods for sample menus for a day's meals. This picture shows the models of the various dishes for a sample breakfast suitable for a child from ten to thirteen years of age. There are 1 cup of oatmeal, 2 slices of toast, 1 tablespoonful of butter or butterine, ⅗ of a cup of cocoa, 1 baked apple with sugar, and ⅔ of a cup of milk. This sample breakfast represents a heat value of 600 calories; it contains 15.76 grams of protein and the necessary amounts of iron, phosphorus, and calcium. Each of the models individually represents a heat equivalent of 100 calories so that the children can readily grasp the idea that a certain portion of food stands for a definite energy content

into a habit of correct eating which will last into adult life.

American Museum Campaign Among the School Children

A special campaign to combat malnutrition is now being conducted in the New York public schools in connection with the school lunch service of the Department of Education. It has been realized that something more must be done than merely provide good lunches for the children. Only about 9 per cent of the children avail themselves of the school lunches, for one reason or another. But even if a child consumed regularly the daily lunch at school, he would be taking fewer than 200 meals out of a yearly total of 1095 or more. This experience alone would scarcely be enough to establish the habits we have been speaking about, since in many cases his other meals at home would tend to destroy the good habits as fast as they were formed. The school lunch must be supplemented by very definite instruction in dietary hygiene.

In this nutrition "drive" the preliminary step of "propaganda" has been accomplished. The children's attention and interest in regard to food matters have been aroused by such means as slogans, posters, and "nutrition days." The Child Health Organization has even contributed a health clown, "Cho-Cho," who lent the glamour of the circus to the simple injunction to drink milk instead of coffee.

The next thing to do is to try to use the interest that has been aroused and teach the child more concretely just what a correct diet is. Dr. Gustave Straubenmüller, associate superintendent of schools, sent to the American Museum of Natural History a request for teaching material. To meet this demand the department of public health of the Museum in coöperation with the department of public education of the same institution has prepared a traveling exhibit for the public schools which it is hoped will constitute a real contribution to the cause of public health education. This exhibit consists of a set of sixteen wax models of foods suitable for the needs of a child between the ages of ten and thirteen, and a set of colored wooden blocks illustrating the composition of six common foods. It includes also eight wall charts.

Correct Diet Taught by Means of Food Models

The food models have been designed to be used in three different ways so as to give a fairly complete picture of the chief lessons of dietary hygiene. In the first place, each

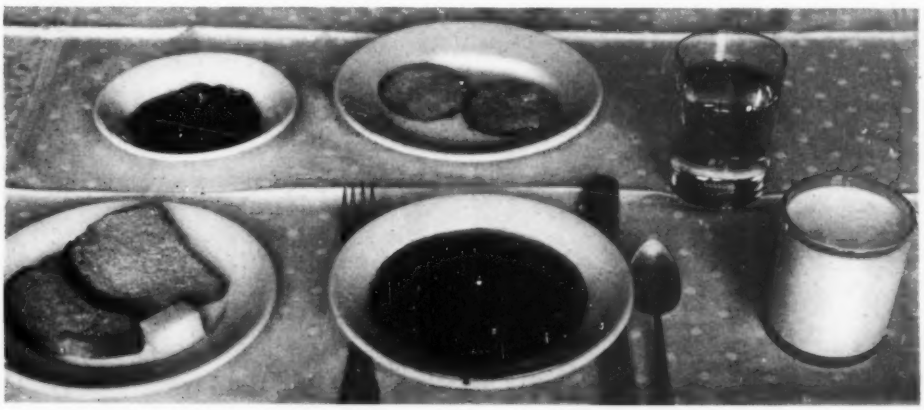
Examples of Foods That Make Up a Healthful Diet for a Child from Ten to Thirteen Years of Age

NECESSARY TYPES OF FOOD	CALORIES SUPPLIED BY EACH TYPE		AMOUNTS THAT SUPPLY THE NECESSARY CALORIES
I. BREAKFAST.— *Total Calories: 400–600*			
Fruit	50–100	Apple	½ to 1
		or banana	½ to 1
		or orange	¾ to 1½
		or Malaga grapes	10 to 20
Cereal	100–150	Rolled oats	1 to 1½ cups cooked
		or cornmeal	
		or flaked wheat	⅔ to 1 cup
		or cornflakes	
		or puffed rice	1¼ to 2 cups
		or shredded wheat	1 to 1½ biscuits
Bread	50–100	Whole wheat or white bread	1 to 2 slices
Butter, or butterine.	50–100	Butter, or butterine.	½ to 1 tablespoon
Milk or Cocoa made with milk.	100–150	Milk	⅔ to 1 cup
		or cocoa made with milk	⅗ to 1 cup
II. DINNER.— *Total Calories: 700–1200*			
Meat, fish or eggs	75–300	Lamb stew	1 to 3 small pieces, 1 to 3 oz.
		or piece of steak	1 to 3 pieces (2×1½×1 inches)
		or eggs	1 egg=70 calories
		or chicken	1 to 3 slices (2×4×¼ inches)
Potatoes, rice, macaroni, etc.	100–200	White potato	1 to 2 medium
		or sweet potato	1 to 2 small
		or boiled rice	¾ to 1½ cups
		or boiled macaroni	1 to 2 cups
Fresh vegetables	25–50	Spinach	½ to 1 cup
		or carrots	1 to 3 medium
		or turnips	½ to 1 cup sliced
		or tomatoes	½ to 1 medium
		or cauliflower	⅛ to ¼ head
		or cabbage	1¼ cups shredded=25 calories
Milk	100–150	Milk	⅔ to 1 cup
Bread	100	White bread	2 slices
Butter	100	Butter, or butterine.	1 tablespoon
Pudding, or similar dish	200–300	Rice pudding	½ to ¾ cup
		or apple tapioca	
		or cornstarch blancmange	
		or Brown Betty pudding	
		or ice cream	
III. SUPPER.— *Total Calories: 400–800*			
Cream soup, or similar dish	200–300	Cream of tomato	1 to 1½ cups
		or celery or spinach	
		or asparagus or pea	
		or split pea or bean soup	
		or mashed or creamed potatoes	1 to 1½ cups
		or boiled macaroni	2 to 3 cups
Bread	50–100	White or whole wheat	1 to 2 slices
Butter, or butterine.	50–100	Butter, or butterine.	½ to 1 tablespoon
Stewed fruit	100–200	Stewed prunes	about 2 to 5 prunes and 2 to 4 tablespoons juice
		or apple sauce	½ to 1 cup
		or stewed apricots	¼ to ½ cup
Cake	50–100	Plain cookies (2¼ inches diameter)	1 to 2
		or lady fingers	1 to 3
		or one-egg cake (two inch cubes)	½ to 1
Milk, or cocoa made with milk	100	Milk	⅔ cup
		or cocoa made with milk	⅗ cup

model represents a 100-calorie portion (or in some cases 50-, 150-, or 200-calorie portions) so that it gives the child a clear grasp of the conception that each food has its definite value as a source of energy for the running of the living machine.

In the second place, the models can be used to show the specific contributions made by each kind of food to the upbuilding of the body, for it is as essential to provide a sufficient supply of calcium and iron, of protein and vitamines, as to supply the total energy which the body needs for its daily activities.

Models of a sample menu for a child's midday dinner, including 1½ ounces of lamb (stew), 1 medium-sized potato, 1 cup of cooked spinach, 2 slices of whole wheat bread, 1 tablespoonful of butter or butterine, 1 cup of milk, and ½ cup of rice pudding. The portions also separately represent a heat value of 100 calories, except the spinach, milk, and rice pudding, which supply 50, 150, and 200 calories respectively. Such an exhibit tells a story which the children can readily understand, and makes clear to them the fact that food is not eaten merely because it tastes good, but rather to build up the body and supply energy for its work



This sample menu for a child's supper consists of 1 cup of cream of tomato soup (200 cal.), 2 slices of bread (100 cal.), ½ tablespoonful of butter (50 cal.), 5 prunes and 4 tablespoonfuls of juice (200 cal.), 1 cup of milk (150 cal.), and 2 cookies (100 cal.). The whole day's food, as represented by the samples illustrated, gives a total heat value of 2200 calories with 64.44 grams of protein, 1.356 grams of calcium, 1.495 grams of phosphorus, and 0.015 grams of iron. The diet of a child from ten to thirteen years of age—the preceding is only a characteristic sample—should always represent 1800 to 2500 calories; one third of these should be supplied from cereals and bread. Further, whatever the daily menu, the child of this age should always have a quart of milk a day, 3 or 4 tablespoonfuls of butter or similar fat, a cupful of fresh, cooked vegetables, 4 or 5 glasses of water, and fruit at one meal at least

Enjoyment of the Forest through Knowledge

By F. F. MOON

Acting Dean of the New York State College of Forestry, Syracuse University

TO most Americans, particularly those living in the cities, the forest is a closed book. Far from being a group of trees merely occupying a certain part of the landscape, the forest is in reality a community of trees having itself a life. Trees, shrubs, and ground-cover, the animal life which roams beneath the forest shade, the fungus and bacterial life of the forest soil—all together form the forest community. In view of the manifold subjects of surpassing interest which the forest affords, it should be the desire of every red-blooded American who loves the open to learn the ways of the forest: how it starts, how it develops, the names and habits of trees; how they, like individuals in the city, compete with one another for food and drink while affording one another protection.

The enjoyment of the green shade of a city park can be multiplied a hundred-fold by those who are fortunate enough to be able to hunt, fish, or camp in a real forest, and strange as it may seem, the fact that forests need to be developed and in some degree prepared for widest, fullest use as recreation areas is at present grasped by only a few. Roads and trails must be cut, camp sites selected and laid out with an eye to beauty and accessibility. Sanitary features must be provided. In short, the wilderness host presents a stern front to those guests who do not know its ways.

Fully to enjoy and profit by a camping experience or even a walk in the woods, one must be acquainted with the woods. Just as a boy or girl going to a new school or to a new town feels strange and ill at ease until he makes acquaintances, so one feels when going into a forest composed of trees and shrubs of whose identity he is ignorant. The first steps should be to know the principal trees and shrubs: to recognize them by their leaf and buds, also from their bark and general appearance. When these have been learned, a ramble among the trees is as enjoyable as a visit to the home of friends. The habits of the trees and their reaction to environment can then be studied. Every tree stands for something and has its definite part to play in the community. Those like the Norway pine, gray birch, and red cedar which are light-demanding and will quickly die if over-topped, will be found growing in the open or in pure stands unmixed with other trees. Others, like the beech, hard maple, or red spruce, which are "tolerant" of shade, will grow for some time beneath a comparatively close canopy made by the foliage of taller trees. The reaction of trees to soil and moisture conditions offers a particularly interesting study. Certain trees like the black walnut and white oak are found large and well developed only where the soil is deep and fresh. The pioneers in the Lake States were accustomed to locate on the land covered with good-sized beech and maple, since these trees indicated soil of agricultural richness. Other species prefer light to soil-fertility and moisture, and can soon be crowded out of the rich bottom lands by shade-enduring trees. This may explain why dry barren pastures may be found covered with a stand of gray birch and red cedar.

When the fact has been grasped that trees have their peculiarities like human beings, a study of the forest community, composed of trees and shrubs, becomes fascinating. Countless instances of the indomitable energy of the tree, its tenacity, its ability to adapt itself to circumstances, can be seen while strolling through the woods. The development of a tree community from a group of wind-sown pine seedlings on abandoned pasture to a splendid stand of pine trees, straight of bole, clear of branches, really constitutes an epic. It is a struggle for existence and the survival of the fittest, an inspiration to those who have eyes to see and a heart to understand. The forest holds many a lesson which the discerning eye can read.

Trees as Friends

It is a pleasure to publish the following extracts through courtesy of the Editor of the *Journal of the New York Botanical Garden*, from Dr. W. A. Murrill's very charming mention of some of the world's best known trees. It brings to mind anew the particular trees which have come close to our own personal experience and thought, especially those connected with our childhood, and emphasizes anew the realization that familiar acquaintance with nature gives a broader and more gracious and generous view of life.

"THE children of the Orient have the bamboo, the ginkgo, the teak, the banyan, and the oriental plane; those of Syria the ancient olive trees and cedars of Lebanon. The children of Norway have the Norway maple, and the Norway spruce; those of Sweden, who live in the very home of Christmas, have also beautiful firs and birches. The Germans love their lindens and horse-chestnuts and fill their fairy stories with references to fir trees; the Swiss children spend their summers on the Alpine pastures surrounded by tall and stately firs and spruces; the Austrian children find the larch on the mountains and a beautiful species of pine in some of the valleys, from the wood of which they carve their Christmas toys; the Italian children, even in the crowded streets of Venice and Naples, cannot fail to know something of the chestnut and olive orchards on the mountain slopes and the pollarded willows of the lowlands. The children of rural France love the long rows of poplars that shade the highways, and those of the cities love their beautiful parks and shaded boulevards; the London lad occasionally turns his eyes from his cricket bat to gaze upon a majestic field elm or a grove of oaks or beeches, while the farmer's boy loves to linger in the shade of the elms and oaks that everywhere dot the English landscape."

"In Cuba, children play beneath wide-spreading laurel trees and royal palms; while in Mexico girls and women loiter and wash their clothes beneath the willows that fringe the streams, or gather wild fruits and flowers under oaks and Montezuma pines. Every child in Mexico City knows the grove of giant cypress trees adjoining Chapultepec and 'La Noche Triste' tree, under which Cortez reviewed his shattered army. The children of California boast of the giant redwoods, still the largest of all trees in spite of rival claims; while those of Washington and Oregon know red firs and other trees almost as large. The boy of the southern United States delights in the magnificent oak, chestnut, and pine forests, and in the beauty and perfume of the southern magnolia; while the boy of the North glories in 'the murmuring pines and the hemlocks' and the valuable forests of maple, beech, and birch."

"In studying history, art, literature, mythology, and the customs of various peoples, a child finds many references to trees and tree lore. If we add to these sentiments and fancies some definite and accurate knowledge of the more common trees in one's locality, together with the life history and needs of trees in general, it means a much broader and happier life for the child and man. Trees will then never be forgotten, but will be recognized and loved as the faces of friends."

Notes

ON February 1, Dr. Robert Cushman Murphy comes to the American Museum as associate curator of ornithology. He will devote his time particularly to a study of the collections made by the South Pacific Expedition; publication of reports upon zoölogical material collected along the east and west coasts of South America is also contemplated.

It may be remembered that some years ago (1912–13) Dr. Murphy went to South Georgia on an expedition conducted jointly by the American Museum and the Brooklyn Museum. The observations and collections made on this trip laid the foundation for his future work on sea birds in particular and oceanic zoölogy in general, which have now become important branches of his studies.

Among other expeditions made by Dr. Murphy was one to Lower California in

1915, while his latest investigations have been among the guano islands along the Peruvian coast of South America.

DR. FREDERIC A. LUCAS is nearing the tenth anniversary of his directorship of the American Museum and the fortieth anniversary of his service to the museums of America. In celebration of this event the American Museum has in mind the publication of a selected series of his papers on museums and museum administration, together with a brief autobiographical sketch and bibliography of his writings for the last forty years.

THE president, trustees, and scientific staff of the American Museum sent their greetings and felicitations on the occasion of the formal opening of the Institute de Paleontologie Humaine in Paris on December 23. The great service to anthropology which this institution has already accomplished is a monument in the history of science which points the way to a bright future of discovery and achievement. The institute was inaugurated by S. A. S. the Prince of Monaco in 1910 for the study of early man and his works. Under its auspices a number of researches have been carried on, notably in certain of the caves in Spain.

THE American Association of Museums has appointed a committee consisting of Mr. L. V. Coleman, chairman, and Dr. E. O. Hovey, of the American Museum, and Mr. H. L. Madison, of the Park Museum, Providence, to report at the Cleveland Convention in 1921 on a plan for classifying museum information and providing for its distribution. It is planned to organize the subject matter of museum technique, administration, and activity on a decimal basis and to arrange for publishing data on loose leaves.

WE regret to record the death on October 8 of Dr. Yves Delage, professor of zoölogy at the Sorbonne and director of the Roscoff Marine Station in France. Professor Delage was preëminent among French zoölogists for his knowledge of shore fauna and his experimental work on parthenogenesis. More than twenty volumes of *L'Année Biologique* stand as a monument to his industry, as well as six volumes of the *Traité de Zoologie Concrète* and many other books, including his notable work on *Heredity and the Great Problems of General Biology.*

AN expedition to Greenland for the further exploration of the north coast regions, including Peary Land, will be undertaken in 1921 as a fitting bicentenary commemoration of the first colonization of Greenland by Hans Egede in 1721. Dr. Lange Koch will lead the party which in the late summer will carry supplies by Cleveland tractors across the ice-free marginal zone at Inglefield Gulf to Warmings Land on the north coast. In the two years following, Dr. Koch will journey by dog sledges with Polar Eskimos. The cost of the expedition is being defrayed by the Danish government and a committee of prominent Danish gentlemen, including Professor Eugene Warming.

THE completion of Knud Rasmussen's study of the Greenland Eskimos is reported by Mr. W. Elmer Ekblaw in the *Geographical Review.* Rasmussen returned late last year from Ammassalik on the east coast. He now knows every Eskimo in Greenland personally and has made an exhaustive study of the language, customs, and folklore. He is himself part Eskimo and was born in Greenland, but later studied languages and ethnology at the University of Copenhagen. His life has been devoted to this anthropological study which he hopes will ultimately comprehend all of the race from Ammassalik to Siberia.

THE statement frequently made that the Hawaiian race is disappearing is erroneous, according to Mr. Louis R. Sullivan, assistant curator of anthropology in the American Museum. Mr. Sullivan is at present making an anthropometric survey in the Hawaiian Islands in coöperation with the Bishop Museum of Honolulu. Although the native stock is rapidly becoming mixed, he estimates that there are at least 20,000 representatives still to be found. In his anthropometric work Mr. Sullivan has received active coöperation from the people of the territory who willingly presented themselves for examination. He has found the average height of the Hawaiians to be 5 feet, 8¼ inches, which is exceeded only by the Scotch with an average height of 5 feet, 8½ inches. Mr. T. C. White, representative of

the Bishop Estate in the district of Kona, accompanied Mr. Sullivan for a month, rendering valuable assistance through his wide acquaintance among the Hawaiians.

THE week after Christmas was as usual convocation week, and the American Association for the Advancement of Science and a number of other scientific societies met in Chicago. Dr. Frank E. Lutz presided at the meetings of the Entomological Society of America and Dr. E. O. Hovey was present as secretary of the Geological Society of America. Dr. E. H. Moore, professor of mathematics in the University of Chicago, was elected president of the American Association to succeed Dr. L. O. Howard; Dr. Simon Flexner, director of the Rockefeller Institute for Medical Research, the retiring president, gave the presidential address, his topic being "Twenty-five Years of Bacteriology—A Fragment of Medical Research."

PHYSICAL anthropology, as the name implies, deals with the material side of man, his bodily characters, such as size and color, shape of the head, character of the hair, points wherein one man or race differs from another. Among other matters it includes detailed measurements of the human body and their relationships to one another, the object being to determine resemblances or differences between individuals or races of mankind, a branch of science termed anthropometry—the measuring of man. Now, in order to have uniformity in measurements so those taken by one worker may be accurately compared with those taken by another, or with those taken by the same worker at different times, certain definite points have been agreed upon by anthropologists. These are usually located where the underlying bones come near the surface, sometimes the bones or joints themselves are chosen, not only because these points are well marked, but so that measurements of the skeleton may be compared with those made on the outside of the body, for sometimes bones only are available, and sometimes measurements must be made on living men.

These selected points are shown in an exhibit prepared under the direction of Mr. L. R. Sullivan and recently placed in the southwest pavilion on the second floor of the American Museum. So far as we know this is the first piece of its kind. It is a life-sized figure of a man showing on the one side the outer part of the body and on the other the skeleton—the points selected for measurements being indicated by labels.

The technique of cephalometry, the detailed measurement of the head and face, is shown in a case near by which includes a set of labels giving a brief history of the subject.

A MEETING preparatory to the foundation of the Institut International d'Anthropologie was held at the Ecole d'Anthropologie of Paris, September 9–14, 1920, in accordance with a circular letter sent out by the school on November 20, 1918. The aim is to found a permanent international organization among all the anthropologists of the allied nations with a central office for the arrangement of periodic sessions, the facilitation of relations between investigators, the centralization of publications, and the development of plans of research in physical anthropology, prehistory, ethnology, and other branches. Dr. Charles Peabody, of Harvard University, was the American delegate. A provisional executive council was elected of which S. A. I. Mgr. le Prince Bonaparte is president. Doctors Clark Wissler, of the American Museum, Aleš Hrdlička, of the U. S. National Museum, G. G. MacCurdy, of Yale University, and Charles Peabody, of Harvard University, are the American representatives on the council.

THE Intercollegiate Cosmopolitan Club of New York City was the guest of President Henry Fairfield Osborn at the American Museum on January 4, 1921. The club is comprised of foreign students who are studying in various collegiate institutions of the city and represents more than sixty nationalities, including Latin America and the Far East as well as many of the European countries. These men and women from the four corners of the earth are absorbing American ways of life and ideals in connection with their academic studies and for that purpose they are brought together by the club in a semi-social way. As the aim of the club is to express the common brotherhood of man, Dr. G. Clyde Fisher appropriately spoke on the interrelations and interdependence of all human life in connection with a special exhibition of the film on "How Life Begins."

Following this lecture the guests made an excursion through various halls of the museum, after which tea was served in the hall of the Age of Man.

A NEW theory of the origin and racial affiliation of the Polynesian peoples was proposed by Dr. Roland B. Dixon, professor of anthropology in Harvard University, in a paper before the American Philosophical Society on April 22.[1] Professor Dixon has reinvestigated all available data, not alone with reference to the cephalic index but also with reference to a correlation between the cephalic index, length-height, and nasal indices, and, whenever possible, the facial index. The conclusions that he reaches are that the primitive underlying strata in the Polynesian area was Negrito. This was followed by a Negroid people such as now inhabit Melanesia and Australia, while the Negritos only survive in remote marginal areas. After the Negroid peoples came a Malayoid or Mongoloid race which absorbed and submerged the preceding types. As the anthropometric data is very scanty, these conclusions can only be regarded as a tentative hypothesis on which more light will be shed by the investigations now under way under the auspices of the Bishop Museum in Honolulu.

DR. RALPH S. LILLIE has resigned his professorship of biology in Clark University to accept the position of biologist in the department of pure science of the Nela Research Laboratories, National Lamp Works of the General Electric Company. He will, however, retain his connection with the Marine Biological Laboratory at Woods Hole, Massachusetts.

THE field of anthropology has been almost entirely lacking in books of a general and introductory type such as would place the principles of the science before the beginning student or the worker in related sciences such as sociology, history, and comparative jurisprudence. Dr. Robert H. Lowie, associate curator of anthropology in the American Museum, has undertaken to supply this lack in the special branch of social organization, and his recent work, *Primitive Society*, constitutes an excellent introduction to social anthropology for the student or interested layman. The author takes up the topics of marriage, kinship, the position of women, property, associations, government, and justice, and outlines the characteristic forms in which each have been found among primitive groups. Dr. Lowie adheres to the historical as opposed to the evolutionary school of antnropology. "The existence of uniformity in cultural history," he says, "cannot be assumed simply because it would be convenient. . . . If there are laws of social evolution, he (the anthropologist) must assuredly discover them, but *whether* there are any remains to be seen . . . Without, therefore, at the outset renouncing the search for laws of social evolution, we will emphatically declare our independence of that pseudo-scientific dogmatism which insists on formulating all phenomena after the fashion that has proved serviceable in a diminutive corner of the field of human knowledge. Uninfluenced by any bias for or against historical regularities, we shall attempt to determine what are the facts and what has been their actual sequence."

DR. CHARLES-EDWARD A. WINSLOW, curator of public health in the American Museum and professor of public health in Yale University School of Medicine, will assume the directorship of the public health activities of the League of Red Cross Societies at Geneva in February. Dr. Winslow expects to return to the United States before the opening of the fall term next October.

DR. HENRY E. CRAMPTON, curator of invertebrate zoölogy in the American Museum, now on an extended expedition to the Orient, reports a very successful trip.

His first period of field work comprised two months devoted to Guam and Saipan in the Mariana Islands. Guam, which is well known as our naval station, is a composite island geologically, as it is formed in part of ancient sedimentary strata much metamorphosed, and in part of uplifted limestone reefs. The island is very interesting in connection with studies of distribution, for certain land mollusks of the genus *Partula* extend to it and to its neighbors, although they are more strictly Polynesian in their habitat. The natives, called Chamorros, are allied to the Filipinos in part. The success here was largely due to the governor,

[1] *Proc. Amer. Philos. Soc.*, Vol. LIX, 1920, p. 261.

Captain Ivan C. Wettengel, U. S. N., who granted many unusual favors and made it possible for Dr. Crampton to proceed by naval vessel to Saipan. Here also the collections were particularly rich in several groups, especially insects.

On August 26 Dr. Crampton sailed for Manila. Through the coöperation of the Philippine Bureau of Science he secured on the island of Luzon a fine series of photographs and from Dean Baker, of the College of Agriculture at Los Banos, a full series of reptiles and amphibians and a large series of named insects. Governor Harrison was much interested in the expedition and placed a coast guard steamer at Dr. Crampton's disposal in order that he might cross Manila Bay to the Mariveles Mountains and see the pygmy natives of that region. On this trip, however, Dr. Crampton was most unfortunately kicked by a vicious horse and was forced to return for treatment.

About the middle of September he sailed for Hong Kong whence he continued up the Canton River to the Canton Christian College. Here at the invitation of the faculty, he delivered a series of lectures on evolution and on Polynesia and its peoples. The zoölogist of the college, Professor Howard, is developing a campaign of systematic collecting in the Canton region which is certain to be exceptionally successful.

Late in September Dr. Crampton took steamer to Bangkok. A few days were spent there in making preparation and then he proceeded to his long-determined goal, the city of Chieng-mai, five hundred miles to the north, where for a few weeks he was the guest of His Serene Highness, Prince Bovaradej, viceroy of northern Siam. Numerous favors were extended and Dr. Crampton was privileged to learn a great deal of the Lao people of this region and of their highly developed culture.

The city of Chieng-mai is beautifully situated on a plain of rice fields, surrounded on almost all sides by mountains of considerable height. Nearly a week was spent in the forests high up on the mountain of Doi Sutep at an elevation of 2700 feet. The American Presbyterian Mission has Rest Houses at different places on Doi Sutep and these were placed at Dr. Crampton's disposal.

On November 8 he started by rail for Singapore, taking several days for the trip down the Malay Peninsula and collecting around Penang and Kuala Lumpus. Thence he sailed to Java on November 19 for a period of field work on that island.

Mr. H. E. Anthony, associate curator of mammals in the American Museum, reports from Ecuador unusual success in securing valuable material. Mr. Anthony, together with Mr. G. K. Cherrie, has been enjoying the hospitality of the South American Development Company, at one of whose mining camps, Portovelo, a base has been established. From here they have collected throughout the southern Andes almost as far as Peru, obtaining about 1200 birds and 640 mammals. This is the largest collection of mammals the American Museum has ever made in South America. The expedition will continue into the eastern Andes and the little known headwaters of the Amazonian drainage system and will subsequently make a cross section of the mountains farther north. Mr. Anthony also plans a reconnaissance for fossils along the west coast.

The last island in the West Indies to be thoroughly investigated, and perhaps the most interesting island of all, from a biological standpoint, is Santo Domingo. The American Museum has received a number of collections from this island. Perhaps the most recent contribution is a series of reptiles and amphibians made by Lieut. J. K. Noble, United States Marine Force, Air Service, and his associates in the First Squadron, Aviation Unit stationed at San Pedro de Macoris, Santo Domingo. A number of photographs taken from an airplane show the possibility of panoramic representation of life zones, so interesting to the students of zoögeography and so clearly marked off on the slopes of most tropical mountains, especially those of the central highlands of Santo Domingo. In a future number of Natural History Mr. Rollo H. Beck will narrate his experiences while bird collecting in Santo Domingo.

The "Lepidoptera of the Congo, Being a Systematic List of the Butterflies and Moths Collected by the American Museum of Natural History Congo Expedition, together with Descriptions of Some Hitherto Undescribed Species" has just been published by Dr. W. J. Holland, director of the Car-

negie Institution, in the *Bulletin of the American Museum*. The collection, which is one of the largest from the region in recent years, is especially rich in the larger and showier species characteristic of the territory covered. It contains nearly 9000 specimens representing more than 725 species and varieties.

MR. A. K. HAAGNER, director of the National Zoological Gardens of South Africa at Pretoria, was the guest of the American Museum on September 21, and delivered an address in the auditorium, illustrated by lantern slides and moving pictures. Mr. Haagner gave an account of the circumstances that rapidly led to the practical extinction of many large South African mammals, such as the blesbok, springbok, white-tailed gnu, white rhinoceros, hippopotamus, and Cape giraffe. In this process of extinction the development of transportation facilities has been a vital factor; the automobile, the motor-boat, and the railroad have finally supplanted the porters' caravan, ox wagon, and "Cape-cart." As a result, most of the larger animals now exist only in reservations, which are often privately owned.

A pleasant surprise was an account of the success attained in breeding wild animals in the Pretoria zoölogical gardens, in part made possible by the relatively mild climate in that region. Conspicuous in this respect were the fine herds of the greater kudu, the Rhodesian cob, South African eland, and buffalo. Among the carnivores successfully bred was a litter of the spotted hyena, suckled by a domestic dog; the quaintest were the young of the long-eared fennec fox.

A splendid film of a herd of elephants, originally taken to illustrate one of Rider Haggard's stories, brought great applause. The huge animals seemed only slightly disturbed on leaving the forest and after entering a remarkably picturesque parkland they scattered among the palm groves. Their actions and grouping often changed and the artistic effect of the picture was heightened by the presence of a great flock of cow-herons which circled over them, some alighting on the elephants' backs. Following a charge across the open veldt, the largest tusker fell to the skill of a hunter and his bushman tracker.

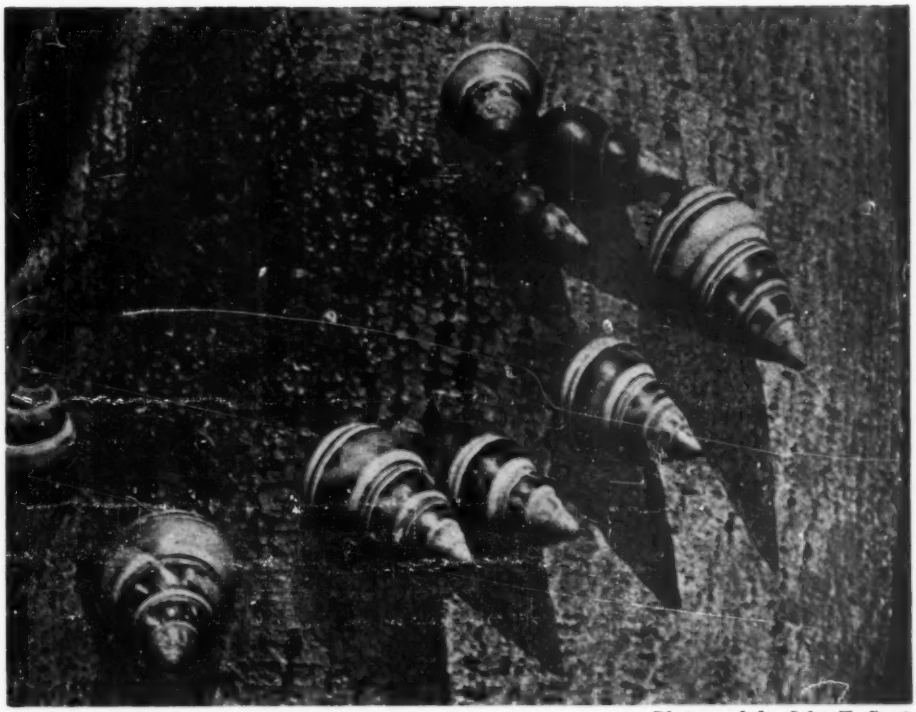
Mr. Haagner has presented to the American Museum a fine skin of the rare mountain zebra which was taken in the Cradock District in the mountains of the Southeastern Cape Colony and which through an accident had perished on the way to America.

THE great moonfish or opah (*Lampris luna*) is one of the strangest fishes of the sea and so unique structurally that it constitutes an order (Selenichthyes) by itself. It is a large fish reaching a weight of four hundred pounds and is characterized particularly by the extraordinary development of the shoulder girdle which is proportionally many times larger than in other fishes. Dr. David Starr Jordan now reports a fossil species of *Lampris* from the diatom bed of Lompoc, California.[1] The specimen is about 3 by 2 feet and is "of great interest as showing the antiquity of one of the most singular of all living fishes, and incidentally with other associated forms, the relative age of the present fish fauna of California."

THE use of the sucking fish (*Echeneis* or *Remora*) for catching other fish was first reported by Columbus and has since been both affirmed and denied by travelers and scientists. Dr. E. W. Gudger, in a series of articles in the *American Naturalist*, collects all the written evidence and actual experiments with *Echeneis*, which tend to show that the method was feasible. The method was to fasten a line around the fish's tail. With its powerful sucking apparatus the *Echeneis* would then attach itself to another fish and the latter could be hauled in and netted. Dr. Gudger estimates from experiment and calculation that an *Echeneis* might stand a pull of about fifty pounds or greater. This pull is sufficient for landing even large fish which are frequently taken with lines breaking at less than thirty pounds dead pull.

THE United States Department of Agriculture has undertaken the investigation of the effect of poisonous plants on grazing animals with the ultimate aim of preventing losses from this source. There are more poisonous plants in the United States than is generally supposed (one list gives 25,000 species). Field stations have been established by the department in localities where the investigators can have immediate access to poisoned stock.

[1] "An Ancient Moonfish." *Scientific Monthly*, Vol. XI, 1920, p. 470.

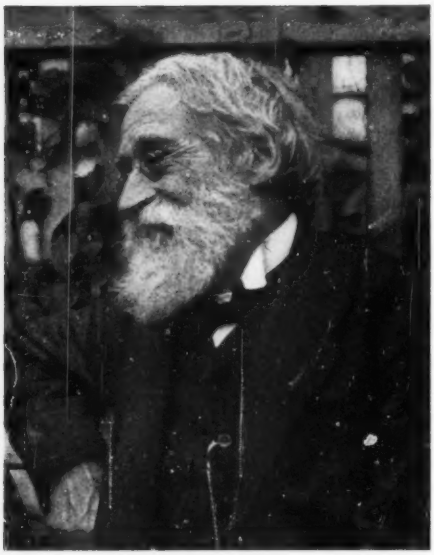


Photograph by John K. Small
Courtesy of G. P. Putnam's Sons

Arboreal snails (*Liguus fasciatus*) æstivating on the trunk of a Jamaica dogwood on Long Key, Everglades. These richly painted mollusks are among the rapidly disappearing fauna of Florida. Their doom is sealed in the destruction of the hammocks by the white man, whose very presence seems fatal to them

THE veteran naturalist, Mr. Charles Torrey Simpson, during more than twenty years of residence and travel in southern Florida, has collected a wealth of observations on the wild life, geography, and geology of that state which he now presents in a volume, *In Lower Florida Wilds*. Mr. Simpson lived on the southwest coast of the peninsula from 1882 to 1886 and explored the tropical wilderness when flamingos and spoonbills, deer, otter, and alligators were yet abundant. The book is a valuable record of a life now in great part passed away. During these many years the author penetrated into the remote Everglades, protected from the curious by swamp-land and sword grass; he explored the ragged coral-bound islands of the coast, and hunted through the once primeval forests. He is particularly interested in the causal features in the natural history of Florida—the origin of the land and the differences of fauna and flora, separated at times by only a few miles of swamp or sea. The presence and distribution of tropical animals and plants Mr. Simpson attributes for the most part to the current of the Gulf Stream rather than to a land bridge or the agency of birds. Among the beauty spots described in the book the most notable are perhaps the hammocks or areas of hardwood trees and rich tropical vegetation. Their great enemy, aside from man, is fire which, strange to say, seems ultimately to benefit the pine woods. Except for the live oaks which he calls the "Achilles of the hammocks" the hammocks would not exist. The pioneer work of this remarkable tree is accomplished by its rapid growth, great resistance, and dense shade which make it a defense against the fires and a blight over the pines. But in a hammock once well established the tropical flora ultimately takes root and the live oak, which has made possible their growth, succumbs to the stifling embrace of the common strangler (*Ficus aurea*).

Mr. Simpson makes an appeal for the preservation of the wild life and forests of these hammocks before it is too late. "They should be cherished for their beauty and for the rare vegetation they contain. Once destroyed they can never be replaced quite as nature has made them, and Florida would be despoiled for all time of one of her most important attractions."



Dr. Franz Steindachner, 1834–1919, renowned ichthyologist and director for fifty years of the Natural History Museum in Vienna

Dr. Franz Steindachner was born in 1834. As a young man he was associated with Agassiz at Cambridge, making collections of fishes for him or with him in California and in Brazil. In the fifties he was called to the K. K. Naturhistorischen Hofmuseum in Vienna, of which he became director (intendant) about 1870, succeeding Dr. Rudolph Kner. As head of this museum he devoted his personal energies to the upbuilding of an extensive collection of fishes, publishing with great regularity a series of papers on the different groups which he studied. These papers are remarkable for their accuracy, especially shown in the description of species, and all were illustrated by the fine lithography of his inimitable artist, Edouard Konopicky. Steindachner was interested especially in details, leaving to others, and usually less careful workers, the great generalizations of his science. With Linnæus he held, *Tyro fit classes, magister species.* "The beginner defines classes, it takes a master to deal with species."

Steindachner's first paper, on the fossil fishes of Austria, appeared in 1859. The last which has reached me is on certain fishes of Brazil and was passed by the British censor as politically safe in 1915.

When the Imperial Government razed the fortress wall of Vienna, they established the Burgring on its site, and from the proceeds of sales founded a Gallery of Paintings, an Opera House, and the Museum of Natural History of which Steindachner became director. But he received scant funds for his work. Outside his artist, taxidermist, and the janitor service, practically the whole expense fell on him. He wrote labels for the specimens and at least a large part of the material received was paid for from his own funds. I find that this was true of the collections I sent him from the West Indies and the Pacific.

Dr. Steindachner never married. He lived in very modest fashion in rooms attached to the museum, where I visited him in 1913. He was a man of medium height, slender and wiry, wearing a full brown beard, silvered with age,—a delightful personality, quiet, modest, and intensely devoted to his museum and his studies.

One of the most terrible results of the war has been its abasement of science with the sufferings it has entailed on scientific workers in central and eastern Europe, the regions where, in Hoover's words, "Human life is worth about three cents."

Steindachner died on December 10, 1919, at the age of 85. His successor, Dr. Victor Pietschmann, writes me that he died of cold, there being no coal obtainable to heat the museum or his own apartments.—David Starr Jordan.

The production of light by animals has always proved a phenomenon exciting admiration and has given rise to much physiological speculation and research. Dr. E. Newton Harvey, professor of physiology in Princeton University, has recently published a monograph on bioluminescence, treating of the underlying physical characteristics and chemical processes in animal light.[1] Dr. Harvey concludes that the luminescence of at least three groups of animals (the beetles, *Pholas,* and *Cypridina*) is due to the interaction of two substances, luciferin and luciferase, in the presence of water and oxygen. Luciferase is a protein substance which behaves in many ways like an enzyme and is used up in large quantities in the oxidation of luciferin in the formation of light. This problem has also been studied extensively

[1] E. Newton Harvey, *The Nature of Animal Light* (Monographs on Experimental Biology), 1920.

by Prof. Ulric Dahlgren, who will contribute an article on the subject to a future number of NATURAL HISTORY.

IN order to provide for the organization of an institute for research in tropical America the National Research Council through its Division of Biology and Agriculture has appointed a committee on organization and incorporation consisting of Messrs. A. S. Hitchcock, of the Smithsonian Institution, and J. W. Toumey, of Yale University, and Doctors D. S. Johnson, of Johns Hopkins University, F. M. Chapman, of the American Museum, Thomas Barbour, of the Museum of Comparative Zoölogy, and W. J. Holland, of the Carnegie Museum, representing the organizations especially interested in the establishment of such an institute.

THE New York Zoölogical Society is organizing a campaign for the protection of the fur-bearing mammals of the world against inroads now being made by the fur trade. A forthcoming number of the *Zoölogical Bulletin* will be devoted to an article prepared by Director William T. Hornaday on this subject. It seems probable that the age of mammals is literally drawing to a close and that by the middle of this century there will be no mammals left except in the game preserves. Even in the preserves great inroads are being made from time to time, as we learn in a letter recently received from South Africa from the secretary of the Society for the Preservation of the Fauna of the Empire. The secretary writes:

"We had a very bad case before us last week, which shows how great is the need for awakening interest in faunal protection at the present time. A game drive on a large scale was organized by about sixty settlers in Zululand, and in defiance of the game laws, with the connivance of the Natal Provincial Council, they rounded up vast numbers of game in the Umpolozi Reserve, and slaughtered them wholesale, leaving the carcasses to rot. About 3000 head of big game were killed, mostly zebra, but including at least two of the last ten white rhinoceroses left in South Africa. The excuse was the prevalence of ragana in the area. As it is now the opinion of the greatest experts on the tsetse that the slaughter of game is quite useless as a preventive measure unless all living things, great and small, be exterminated in the area, it seems all the more deplorable."

THE New York Zoölogical Garden reported the birth of a chimpanzee on July 14, 1920. The event was noteworthy in that this is the second chimpanzee known to have been born in captivity. As the literature on the subject of the breeding of anthropoid apes is small, the accounts by Dr. W. Reid Blair in the *Zoological Society Bulletin* and *Zoopathologica* are of considerable scientific interest. The mother unfortunately was unable to nurse her offspring, and it lived but eight days.

THE great length of time which a hippopotamus can remain under water without coming to the surface for air has been noted in the case of a specimen in the London Zoological Gardens. This animal, timed by his keeper, remained submerged in clear water for 29 minutes. The hippopotamus, "Guy Fawkes," which died in the same garden in 1905, is also credited with a long immersion under unusual circumstances. A dog which one day strayed into his enclosure was furiously pursued into the water tank and crushed in the jaws of the hippopotamus. The latter seemed very much disturbed by the occurrence, and the next day when the enclosure was opened he plunged to the bottom of the tank. After half an hour the keeper, supposing that the animal was dead, prepared to drag the tank to recover the body, whereupon the hippopotamus rose again to the surface.

THE American Ornithologists' Union held its annual meeting in Washington from November 8 to 11. It was one of the most largely attended meetings in the history of the Union, with one half of the total number of fellows and 10 per cent of the entire membership present. A feature of the occasion was an exhibition of illustrations of birds by American artists and a series of prints showing the evolution of ornithological illustration from the earliest times. Dr. Witmer Stone, curator of the Academy of Natural Sciences of Philadelphia, was elected president for the ensuing year. Six papers were read by the following members of the staff of the American Museum: Dr. F. M. Chapman and Messrs. W. DeWitt Miller, J. P. Chapin, and Ludlow Griscom.

THE continuation of Major Charles Bendire's monumental work on the life his-

tories of North American birds has been undertaken by Mr. Arthur Cleveland Bent. Mr. Bent has published the first section as "Life Histories of North American Diving Birds—Order Pygopodes," with illustrations from numerous photographs of habitats and nests and fifty-five color plates of eggs.[1] Unfortunately, for reasons of economy, it was not found possible to bring Mr. Bent's volume — especially the plates — up to the standard of Bendire's work. Mr. Bent includes the hitherto unpublished reports on Arctic bird life of the Crocker Land Expedition in so far as they relate to his group, together with photographs made by members of the expedition.

THE discovery of a sculpture dating from 1561 of the extinct dodo is recorded by Dr. A. C. Oudemans from the town of Vere on the little island of Walcheren, Zeeland. This is the oldest known representation of the dodo, which became extinct in the seventeenth century. Dr. Oudemans considers it a good figure, modeled after an actual specimen. He has compiled a monograph (in Dutch) on the dodo, its anatomy, habits, distribution, and the literature thereon, and publishes therewith a series of rare or forgotten illustrations, including photographs of the Vere sculpture. A good reproduction of this giant, awkward, aberrant pigeon may be seen in the hall of birds of the world in the American Museum.

THE first engagement in the fight to maintain Malheur Lake Reservation, Oregon, as a wild-life sanctuary has been lost by the forces in favor of conservation. In November the people of Oregon voted down a bill, initiated to give a clear title to the United States Government to the land and water rights of this tract. Malheur is a shallow lake about fifteen miles long by nine wide, surrounded by marshy land which, it is believed, is the greatest breeding ground for wild fowl in the country. It was set aside by executive order of the late President Roosevelt in 1908 "for the use of the Department of Agriculture as a preserve and breeding ground for native birds." Under the proposed law it would have been rechristened "The Roosevelt Bird Refuge," but for a number of years certain promoters with eyes only for commercial exploitation have been urging the state of Oregon to bring legal proceedings to get control of the reservation in order to drain the lake and sell the land for agriculture. Already the lake is on the verge of drying up as a result of the diverting of most of the waters from the Silvies and Blitzen rivers for irrigation. The proposed law would have corrected this situation in part and have given positive title to the Federal Government.

Myriads of water fowl have been accustomed to breed here—Canada geese, mallards, redheads, pintails, gadwalls, cinnamon teal, ruddy ducks, California and ring-billed gulls, night herons, great blue herons, Farralone cormorants, white pelicans, three species of grebes, bitterns, rails, avocets, stills, phalaropes, snipe, kildeers—and the lake is the only place in Oregon where the white heron or American egret, which in 1908 was all but extinct, is to be found. Two colonies of this most beautiful of American plumage birds were discovered near the lake in 1919 by Mr. William L. Finley, field agent for the Audubon Society, and, given opportunity, they would no doubt become numerous again. The land which might be salvaged by the drainage of Malheur Lake region, as was reported in NATURAL HISTORY for December, 1919, has been shown by investigations of the United States Biological Survey to be too alkaline for anything but coarse grass. No economic development of any importance can result from destroying this ancient home of the birds. There is no other spot among the arid lands where they can raise their broods, and the citizens of eastern Oregon fail to realize that the birds themselves are an asset, not only from the æsthetic and natural history point of view, but in dollars and cents as measured by the protection they afford to crops from insect pests and in the maintenance of a legitimate game supply. There is still possibility that through prompt action by the Federal Government this bird sanctuary may be spared. Bird lovers and sportsmen all over the country should give the matter wide publicity and do all they can to bring about the creation of a permanent Federal reservation.

APROPOS of the recent article on the redwoods in NATURAL HISTORY a member of the staff of the American Museum who visited the western coast last summer writes: "Of

[1] Smithsonian Institution. *Bulletin* 107, 1919.

the routes covered none seemed at the time more beautiful or made a more lasting impression than the ride from Grant's Pass, Oregon, to Eureka, California, a two days' trip, much of it through the wildest and most wonderful forest region still remaining in America. On the second day, after leaving the cleared area about Crescent City and climbing the steep hills which nearly everywhere along that coast extend to the ocean shore, the traveler sees little of civilization and little of the effects of human destructiveness. The road winds among hills and ravines densely clothed with a magnificent redwood forest, the great trees growing in places in dense, nearly pure stands, but more often intermingled with tall firs and hemlocks and, farther south, with Sitka spruces and lowland white firs, which are often scarcely less impressive than the redwoods. At times the highway comes out on the bare bluffs bordering the P ific, affording a view out over the ocean and the white surf breaking far below. But the most impressive feature of the trip is the long stretch of almost absolutely wild and undamaged forest, through which the road passes, and the magnificent size and height of its constituent trees. The mountainous country, the remoteness from large centers of population, and the lack of good harbors along the coast have alone saved this region up to the present time; they cannot save it much longer. If prompt action is not taken, all this natural beauty will be destroyed in order that a few people may make money out of what should be the property of all."

IN 1895 when the New York State Legislature put the beavers under absolute protection it was estimated that there were not more than five or ten individuals in the state. This year the Conservation Commission estimates that in the Adirondacks alone there are 15,000 or 20,000 of these animals. From virtual extermination in the state the beavers, under twenty-five years' protection, have increased to such an extent that measures are being considered for their restriction. The beaver in times past was an important economic asset and was hunted for its valuable pelt. The animals, however, are very destructive to trees, cutting down large numbers for use as food and to construct their "houses," and flooding large areas with the dams they build. Last year the Conservation Commission supported a bill providing a short open season, but it failed of action. The annual increase, amounting to about three thousand animals, might well be taken and would yield a considerable cash dividend.

EVIDENCE of a recent world-wide sinking of the ocean level to the extent of about twenty feet is presented by Dr. Reginald A. Daly, professor of geology in Harvard University, in the June number of the *Geological Magazine*. Professor Daly offers his own field observations and marshals a large amount of published data to show the presence of a strand about twenty feet above high tide, dating from post-Glacial times. As there is no evidence warranting the belief that the ocean basin has been sufficiently enlarged in recent times to admit of this change, Professor Daly proposes the hypothesis that the lowering of the sea level has resulted from the increase in thickness of existing nonfloating glaciers and ice caps. For example, a sinking of this extent would result if the Antarctic ice cap were thickened by about seven hundred feet.

THE part played by military geologists on the Western Front has recently been officially summarized by Mr. Alfred H. Brooks, formerly chief geologist on General Pershing's staff. Mr. Brooks points to a number of hopeless enterprises, expensive in lives, that were undertaken because the responsible officers failed to take account of the geological factors. The principal applications of geology were the determination of underground and surface-water conditions and the physical character of the soil, subsoil, and bed rock, with special reference to fieldworks and the determination of road material and the influence of soil and subsoil during wet and dry seasons on the movement of troops. It was also found that the geologic conditions affecting electrical transmission entered into the use of listening devices such as were extensively used in trench warfare. The value of geologic knowledge to an army in the field became so evident as the war went on that toward its close nearly all the powers had organized geological staffs.

AT a symposium before the Geological Society of America on the teaching of geology and palæontology Professor Charles

Schuchert, of Yale, read a paper on "American Palæontologists and the Immediate Future of Palæontology." Professor Schuchert estimates that there are but 37 invertebrate and 17 vertebrate palæontologists and 4 palæobotanists actively engaged in constructive work in North America. The great shortcomings and restriction of palæontology are due, Professor Schuchert thinks, to its dominance by the geologists especially in the universities. Historical geology should be taught by palæontologists rather than by geologists. The invertebrate palæontologists have further been dominated by geological interests in that about 90 per cent of their work is chronogenetic while the biological aspects of the subject have been allowed to pass into the background.

EVIDENCE for a former land connection between Patagonia and Australia by way of the Antarctic Continent has long been seen in the presence and restriction to these two regions of the frogs of the family Leptodactylidæ. It has, however, been maintained by some that this distribution was merely a case of convergent evolution. The latter hypothesis is definitely excluded and the existence of the land bridge established, according to Dr. Maynard M. Metcalf, by the discovery in the two branches of Leptodactylidæ of closely similar species of parasite (*Zelleriella*).[1] These parasites are in turn confined to South America and Australia. That both similar frogs and similar parasites should have arisen together by parallel evolution in remote quarters of the earth would seem unlikely.

DR. LEON A. HAUSMAN, who recently contributed an article on "Mammal Fur under the Microscope," has just published in the *American Naturalist* a much more extended paper, with numerous illustrations, on "Structural Characteristics of the Hair of Mammals." This work of Doctor Hausman's emphasizes the fact that there is plenty of work at hand for him who has his eyes open. It may be recalled that microscopic structure of hair has now and then played an important part. About fifty years ago a murder trial in England hinged on the question of blood and hair adhering to a knife. The defendant claimed that this came from a rabbit that he had skinned, but microscopic examination showed that the blood corpuscles were human in their character and that the hair was not that of a rabbit but of a squirrel, and the murdered woman had worn a tippet made of squirrel's fur.

THE application of statistical methods to meteorological data has been made in order to determine the effects of various kinds of weather on crops during various stages in their development, to calculate the risk from unfavorable weather, and to correlate the weather relations over various parts of the country. Mr. Thomas Arthur Blair, meteorologist in the United States Weather Bureau, reviews the progress in the United States of this new branch of meteorology in a recent number of the *Scientific Monthly*.[2] An example of the results achieved may be seen in the determination made by Professor J. Warren Smith that the yield of corn in Ohio is dependent upon the rainfall during June, July, and August. The difference between three inches of rainfall in July and five inches means the difference in yield between 30 and 38 bushels an acre, or 27,300,000 bushels for the state. One half inch of rainfall less than 3¼ inches reduces the state crop by 15,000,000 bushels, and each quarter of an inch increase between 2 and 4 inches adds an additional $7,800,000 to the crop. Closer calculation indicates that the critical period for corn in Ohio is during the first ten days in August. This is the time when the extra rain must fall, if a big crop is to result. Such determination of critical periods is of great importance in practical agriculture inasmuch as the climate of most of the United States is known in detail and accordingly it may be predicted whether a specific crop is climatically adapted to a particular locality. Further, inasmuch as the development of a crop can be advanced or retarded within limits, the time of its arrival at a critical period may be controlled to a certain extent and the proper stage of development caused to occur at a time when favorable weather conditions are most likely to exist.

THE plant and animal life in a freshwater pond, with especial reference to roti-

[1] "Upon an Important Method of Studying Problems of Relationship and of Geographical Distribution." *Proc. Nat. Acad. Sciences*, Vol. VI, 1920, p. 432.

[2] "The Mathematician, the Farmer and the Weather." *Scientific Monthly*, Vol. XI, 1920, p. 353.

fers or wheel animalcules, will be depicted in a companion study to the Bryozoa group at the American Museum. Field work is at present in progress in southern New Jersey under Mr. Roy W. Miner in coöperation with Mr. Frank J. Myers, who has recently been appointed a research associate in the American Museum.

SYSTEMATIC trapping of birds for banding is far more productive of results than merely banding young birds in the nest, according to Mr. S. Prentiss Baldwin[1] who reports on four years' experience in this work. The birds regarded the traps as feeding stations and showed no fear. By the extensive capture of adults in this way a large number of records of birds returning to their last year's feeding grounds was obtained. Mr. Baldwin considers the chances are about one in five that a migrant will return to the same locality to winter. Information may also be supplied by this means of the routes birds follow in migrating and the length of time they spend at various feeding grounds on the way.

THE progress in the purchase of eastern national forests during the last nine years is reviewed in the August number of *American Forestry*. By the Weeks Law of 1911 provision was made for the protection of the headwaters of navigable streams by the maintenance of forests. The original appropriation was for $11,000,000 to which $3,600,000 has since been added. Under this act 1,841,934 acres of spruce and hardwood have been or are being acquired at an average price of $5.26 an acre. These purchases represent the only provision so far made for conserving the timber supply of the eastern states and are of especial importance as they include hardwoods practically limited to these states. There are about 30,000,000 acres of hardwood and spruce land in the East unsuited for agriculture, which should be maintained for all time as productive forest.

AT the invitation of the government of the Republic of Haiti, Mr. W. P. Woodring and several other representatives of the United States Geological Survey have gone to that island to conduct a geological reconnaissance.

THE Rockefeller Foundation reports that during 1919 its activities in public health and medical education have been carried on in twenty-five countries besides the United States.[2] "The war against disease is a world war." There is no use purifying one community, if its neighbors remain a constant source of infection. The foundation has been pushing the fight against yellow fever into its strongholds in South and Central America and Africa. Dr. Hideyo Noguchi, of the foundation's staff, has apparently isolated the infecting organism of this fever. Attacks were also continued against the malarial mosquito in the southern states and against the hookworm disease in remote corners of the world. An exhaustive bibliography on the latter disease is now nearing completion and will, it is hoped, be published soon. In France the campaign against tuberculosis was continued and extended. The largest work of the foundation—as measured financially—is the introduction of Western medicine into China through the medium of the China Medical Board. A modern medical center is being raised in Peking where premedical, medical, and graduate study will be offered and a standardized hospital maintained for clinical study, training of nurses, and as a model for imitation by the Chinese. Three of the school's buildings were occupied in October, 1919, and the whole plant will be ready by January, 1921.

A TIMELY publication on the races of Russia has been written by Dr. Aleš Hrdlička,[3] giving an account of the origins and characteristics of the Russians. This people which is essentially Slav is increasing at a rapid rate, more rapid than the increase of any other large branch of the white race, and so bids fair to become one of the predominating factors in the Europe of the future.

THE American Museum of Natural History is to receive an unconditional bequest of $15,000 from the estate of Mrs. Fanny Bridgham.

[1] S. Prentiss Baldwin, "Bird Banding by Means of Systematic Trapping." *Abstract of the Proceedings of the Linnæan Society of New York.* For the Year ending March 11, 1919. No. 31, 1919.

[2] George E. Vincent, *The Rockefeller Foundation: A Review for 1919*, New York, 1920.

[3] *Smithsonian Misc. Coll.* Vol. LXIX, 1919, No. 11.

AN exhibition of paintings of birds by Mr. Courtenay Brandreth was recently held at the American Museum. The exhibit will be reviewed by Dr. Frank M. Chapman, curator of ornithology, in a future number of NATURAL HISTORY.

THE library of the American Museum has continual inquiry for back numbers of the AMERICAN MUSEUM JOURNAL and NATURAL HISTORY, and urges that those subscribers who have copies which are no longer needed will send them to the Librarian. They may be sent by express, collect.

MR. DONALD B. MACMILLAN, leader of the Crocker Land Expedition of 1913, announces that this spring he will start on another two-year trip to the Arctic for scientific investigations.

THE second and last volume of *Wild Flowers of the State of New York*, by Homer D. House, state botanist, has just been received. The most notable feature of the work is the extraordinarily fine series of color plates illustrating most of the species. A more comprehensive illustrated review of the volumes will be given in a future number of NATURAL HISTORY.

A HISTORY of American state geological and natural history surveys has been compiled by Dr. George P. Merrill, head curator of geology in the United States National Museum.[1] North Carolina, it appears, inaugurated the first geological survey with an appropriation of $1250 in 1824. This was undertaken during spare time by Professor Denison Olmsted, of the State University, who had urged it upon the legislature as an economic measure. The results of Professor Olmsted's work were published in two booklets of 44 and 60 pages respectively.

To Massachusetts, however, belongs the credit for the first really comprehensive survey, undertaken and carried to completion. It was begun in 1830 under Professor Edward Hitchcock, of Amherst, assisted by a corps of naturalists in other branches than geology. Other states soon followed, so that, by the end of the Civil War, thirty-three had carried forward surveys to a greater or less degree.

[1] Smithsonian Institution. *Bulletin* 109, 1920.

DR. G. A. BOULENGER, curator of reptiles and amphibians in the British Museum (Natural History), recently issued a revision of the family Lacertidæ with special reference to specific variation. The monograph combines a number of years' research some of which has already been published elsewhere. This is Dr. Boulenger's last work in his official capacity at the British Museum, from which institution he has withdrawn in order to take up botanical researches in the Gardens in Brussels. A brief bibliographical notice of this monograph of the Lacertidæ appears in the *Annals and Magazine of Natural History* for December. The author of that note comments on Boulenger's retirement in the following words: "All zoölogists must regret that the most distinguished of living herpetologists is no longer officially connected with the unrivaled collection which he has done so much to build up."

THE curatorship in plant pathology has been established at the Brooklyn Botanic Garden and provision will be made early in 1921 for an experimental greenhouse and grounds. Dr. George Matthew Reed, pathologist in the office of cereal investigation of the United States Department of Agriculture, and previously assistant professor in botany at the University of Mississippi, has been appointed to this position. In 1916–17 Doctor Reed spent eight months at the Brooklyn Botanic Garden and during that time made a study of the diseases of the trees and plants of Prospect Park and the Botanic Garden, the results of which were published in the *Record* for January 1917–18. In addition to his research work, Doctor Reed will act as curator of the Cryptogamic Herbarium and will have general oversight of plant diseases in the conservatory and plantations.

DR. C. S. SHERRINGTON, professor of physiology in Oxford University, was elected president of the Royal Society on November 30. Professor Sherrington is the leading authority on the physiology of the central nervous system. In 1906 he delivered the Silliman Memorial Lectures at Yale University and on the text of these lectures was based his most notable published work, *The Integrative Action of the Nervous System.*

A TABLET to commemorate the discovery by Dr. Hideyo Noguchi of the yellow fever organism has been ordered placed in the laboratories of the Public Health Department of Guayaquil, Ecuador, by the municipal authorities. Dr. Noguchi made this discovery while pursuing researches in these laboratories for the Rockefeller Foundation.

THE annual meeting of the New York Academy of Sciences was held in New York City on December 20. Baron Gerard De Geer, of Stockholm, Sweden, addressed the meeting on "How and Where To Determine the Pleistocene Time Scale in the United States and Canada," and Dr. Robert Cushman Murphy spoke on "The Natural History of the Humboldt Current and the Islands of Peru." Dr. Edward L. Thorndike, professor of educational psychology in Columbia University, was reëlected president of the society for the ensuing year.

THE American Meteorological Society held its first annual meeting in Chicago on December 29. The presidential address was delivered by Professor Robert DeC. Ward on "Climate and Health, with Special Reference to the United States."

SINCE the last issue of NATURAL HISTORY the following persons have been elected members of the American Museum:

Patron, MRS. A. H. BRAWNER.

Fellow, MISS MARY CYNTHIA DICKERSON.

Life Members, DOCTORS JOHN A. FORDYCE, GEORGE M. MACKENZIE, MESSRS. C. MONTAGUE COOKE, JR., GEORGE M. DEXTER, WALTER F. DILLINGHAM, HARRY HARKNESS FLAGLER, ROBERT S. KILBORNE, PIRIE MACDONALD, CHARLES A. MAURICE, E. E. SMATHERS, and RICHARD WELLING.

Sustaining Members, MESSRS. CHARLES STRAUSS and FRANK D. WILSEY.

Annual Members, MESDAMES THOS. GARRETT, JR., H. E. GIBB, WM. S. GORDON, SAMUEL HAMMERSLOUGH, EUGENE HODENPYL, EDWIN C. JAMESON, DWIGHT A. JONES, JOHN T. SMITH, PAUL STARRETT, JOS. EARLE STEVENS, HERBERT K. STOCKTON, ROBERTS WALKER, MISSES MARY DOHERTY, CHARLOTTE REGESTER, RUTH LANGDON ROGERS, M. W. SHAW, DOCTORS ALBERT R. LAMB, VICTOR C. PEDERSEN, MESSRS. CHARLES DEXTER ALLEN, HAROLD B. ATKINS, A. C. BEROLZHEIMER, RAYMOND BILL, CHAS. E. BRYANT, L. J. CALVOCORESSI, WINTHROP CHANLER, JOHN GRANT DATER, WILLIAM S. DENISON, H. DE WETTER, GEORGE D'UTASSY, ALFRED FRANK, WILLIAM O. GAY, ARTHUR GREENBERG, FRANK E. HAFF, HERMANN HAGEDORN, H. I. HARTSHORN, PAUL M. HERZOG, VICTOR R. HESS, WALTER S. HILBORN, JOSEPH E. HOFFMAN, LAURENCE C. HOLDEN, HENRY A. HOVET, CHARLES E. HUGHES, JR., FREDERICK W. JACKSON, J. EDWARD JETTER, C. H. KEEP, D. EMIL KLEIN, LOTHAIR S. KOHNSTAMM, CLAUDE W. KRESS, ALEXANDER H. KRIDEL, LOUIS KROWER, VITUS C. LAMBERT, CLINTON H. LEGGETT, HAROLD M. LEHMAN, MOE LEVY, ROBERT LISSAUER, PHILIP LIVINGSTON, MAURICE LOBSITZ, ALBERT C. LUDLUM, E. L. LUEDER, WM. M. MACFARLANE, K. MANDELL, HENRY METCALFE, JULIUS PRINCE, GAVIN ROWE, ISIDOR S. SCHWEITZER, A. J. SELIGMAN, A. RANGER TYLER, L. L. WINKELMAN, G. BYRON WOOLLEY, and the WASHINGTON SCHOOL.

Associate Members, MESDAMES G. S. J. OLIVER, JOHN C. OLMSTED, MISSES T. MAE MACNAB, KATHERINE E. H. VAN WINKLE, DOCTORS LEWIS B. AMSBRY, ROSWELL P. ANGIER, WILLIAM WALLACE CAMPBELL, I. C. CHASE, A. P. DURYEE, D. H. GALLOWAY, OLIVER E. GLENN, H. LEIGHTON KESTEVEN, HERBERT W. RAND, L. D. RICKETTS, ALBERT HAZEN WRIGHT, THE REVEREND JAMES M. OWENS, PROFESSOR C. OLIVER SCHNEIDER, MESSRS. E. J. ARMSTRONG, HORACE W. BABCOCK, DON O. BAIRD, M. A. BECK, FRED M. BULLARD, HAROLD O. BURDICK, HENRY M. CANBY, THOS. CANTLEY, CHARLES C. CARSON, FRANCIS B. COOLEY, T. G. DABNEY, ERWIN A. ESPER, LAURENZ GREENE, HOFFMAN R. HAYS, WILLIAM HURD HILL, ERWIN P. HILTS, CHARLES C. JACKSON, OWEN W. KENNEDY, A. M. LINDSAY, JR., HARVEY HARLOW NININGER, C. M. PALMER, C. S. PARKER, CARROLL CHURCHILL PERRY, JR., HAROLD SHARP, W. MOSELEY SWAIN, W. G. SWART, ROY M. WHELDEN, and RALPH WILLIAMS.

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